The Monthly Review of the AMERICAN ELECTROPLATERS' SOCIETY

CONTENTS

Editorial
1940 Convention
Advertising Campaign
Towne — The Finishing of Die Cast Products
Smith — Purification and Filtration of Plating Solutions
Here and There
Electro-Tinning (An Abstract)
Branch News
$50.00 Award
Letter from Our President
The Abstract Section
Membership Report
Buyers' Guide
Branch Directory
Index to Advertisers

SEPTEMBER 1939

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Chicago, Ill.

CLEPO CLEANING COMPOUNDS

The Monthly Review

Published by the AMERICAN ELECTROPLATERS' SOCIETY, Inc.

A Society for the Advancement of the Science of Electroplating

SEPTEMBER 1939

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The MONTHLY REVIEW

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Editorial

We recently received a questionnaire through the mail, sent by one of the large automobile companies and asking every conceivable question about an automobile and the personal preferences of the one filling in the answers, who was not to reveal his identity. "Do you buy your own automobile, or does your wife wear the pants in your family?". Do you prefer the seats fastened to the floor or would you rather have them suspended from the roof"? etc. etc. etc.

Undoubtedly you have had similar questionnaires on all kinds of subjects. "Do tomatoes taste better to you coming from a can with a pink label than from one with a green label"? etc.

Idly running through the questions we saw one which interested us. It asked us to check whether we preferred lots of chromium plating or very little chromium plating. We grinned gleefully and immediatley set to work filling out the whole questionnaire in order to register our vote on that one question. Which led us to speculating on how many other people connected with the industry would have done the same.

We are a little afraid that the industry does not take itself as seriously as may be for its best welfare. Our growth was very rapid, and in the main, very satisfactory. However, we must not lose sight of the fact that whenever any industry gets up, other industries immediately start gunning for them.

We have no desire to stand in the road of progress, provided it is progress, but if it is simply the desire of someone else to take our business away from us, that is another matter. "Them's fighting words".

Of course we are threatened by both alloys and plastics, and anyone who does not recognize it, had better wake up. Both have their uses, and perhaps in some cases, they may cut into our field to some extent with perfect justification.

However, it is pretty hard to beat a cheap base metal made

attractive in appearance and lasting in service through a good plate. Our problem is going to be to prevent anyone from just sweeping our business away by means of mass hysteria.

Our daughter was married in June and the wedding presents came from widely scattered points. We were struck by the fact that a considerable number of people sent presents with a finish which we had never before seen. We do not know whether or not all of them came from China, but some certainly did. If that was a beautiful finish, we are a Hottentot, and it had absolutely no corrosion resistance. Yet a lot of people with everything in the world from which to choose, elected to buy articles with that finish. The only conceivable reason for their action it that it was new and different.

That is our real danger. People like something different regardless of whether or not it is as good. In a sense, we have had our vogue and become somewhat of an old story. Our present problem is to consolidate our gains and not permit anyone to take them from us, just because they want to be the vogue and carefully foster it by advertising in all ways.

There are some concrete actions which we can take. In the first place, we can be careful always to produce a grade of plate which is used to give adequate and lasting service under the conditions in which it is to be used. We can produce that plate under methods which give a minimum cost, without lessening the attractiveness of the finish or the utility of the service. We can advertise plated products and instead of taking an attitude of apology because they are plated, educate the public to the solid merits of a plated article for specific purposes, and there are countless cases of real merit along these lines, and also the dangers to the buyers arising from substituting other materials with different characteristics and lacking the strength, non-inflammability, and lasting service qualities of a good plated article. Let's start bragging about what we have.

However, the platers, themselves, along with employees of supply houses who are dependent upon the platers for their living, can go still further.

In the main, they have contacts with the designing engineers in the particular business in which they are employed. If they will work at it, they can do a great deal to influence opinion of these designers. Any business wants to produce goods that can be sold readily, and one of the easiest methods of accomplishing that is to give the public something new and different. On the other hand, if they are wise and not just fly-by-nights, they do not want to produce articles which prove to be unsatisfactory for the purpose, and which will kick back in their face later on. Naturally de-

signing engineers have their ears to the ground all of the time for new things which can be applied or substituted in their product, but they do not want to make any mistakes. The plater can, if he will, be sure that the designer appreciates every possible merit to be gained from the continuance or even addition, of plated parts in his particular product. He can educate the designer regarding the possibilities of different types of plated finishes, if he wants a change in appearance.

The chromium vogue has created the idea in the minds of the public that a plate is something bright and shiny. We are rather afraid that designers also have that same opinion in a degree, and that they have lost sight of the fact that plated finishes may be black, or brown, or green, or yellow, or red, or most anything else desired. Perhaps we have become too standardized for our own good. The old-line plater over in one corner of the plant with a few small tanks and crocks, probably was asked to produce more types of finishes in one week than a modern plater does in a life-time. The finishes are available if the designer must have something different, and the plater can see that he understands it.

In addition there are two courses of action that everyone drawing their income from the industry can pursue. We can all talk and buy plating. Propaganda is a very powerful weapon. There are a lot of people dependent upon the plating industry in one way or another, and if they all consistently made it a practice to talk up the merits of plating, it is surprising how a leaven of that kind increases and sways popular opinion.

Still more concretely we can make a practice of buying plated articles. That does not mean that we want plated broom-handles. It does mean that when we are confronted with a choice between a plated and non-plated article, that we choose the former, and still more important, that we tell the retailer why we did it. Every one of us spends a good deal of money in the course of a year for such things as bridge prizes, wedding presents, birthday presents, Christmas presents, etc. Generally there is rather a wide choice on such articles. Instead of buying the men red ties as prizes, buy them plated cigarette cases. Instead of buying the gal perfume that comes in a glass bottle, pick out a silver-plated vase for her.

It is impossible to estimate how much actual buying power of that charater exists in the industry, but our guess is that if it were all used for the purpose, that it would run to a quarter million dollars per year. Spread around among a lot of concerns that will not cause any extra dividend payments, but it will not cause any bankruptcies either.

To accomplish its main purpose, the retailer must understand

why the particular choice was made. They are extremely sensitive to that kind of thing, and of course, it passes back to the manufacturer.

We are well aware that the female contingent does most of this type of purchasing, and they want to do just what they want to do without any conditions or limitations. However, if you manage to sell the good wife on the proposition that it is to your eventual advantage, she will do a lot more effective talking than you would.

Let's all get plating conscious, and throw up an effective barricade in every possible way against any inroads on our territory.

Wing your way to Dayton
the Birthplace of Aviation

1940 Convention

The 1940 Convention of the American Electroplaters' Society to be held in Dayton, Ohio promises to be one of great interest. Dayton offers itself not only as a city of industrial importance, but also a city of historical interest.

The city was laid out in 1796 on the bank of the Great Miami River by a group of Revolutionary War Soldiers. It was named for one of the former soldiers, General Jonathan Dayton, who was then a representative to Congress from New Jersey. After the opening of the Miami and Erie Canal in 1828 it grew rapidly from a log hut village to a city whose future was destined to play an important part in the progress of the world. As a memorial to these early settlers of Dayton, the first log cabin erected, is still preserved with its original furnishings.

In 1841 Dayton was chartered as a city, and today with a population of over 240,000 it is the sixth largest city in Ohio.

Dayton citizens pioneered the Commission-Manager form of government which has been adopted in numerous cities throughout the country.

Dayton is recognized by the world as the birthplace of aviation as it was here that the Wright Brothers began their experiments with airplanes. Progressing from gliders as a sport, they developed the motor driven plane in which they made the world's first flight at Kitty Hawk, North Carolina in 1903.

Dayton has since become the hub of the government's aviation activities with its two flying fields. Wright Field, the Experimental and Research Department of the Army Air Service contains within its 5,000 acres the original flying field of the Wright Brothers. A short distance from Wright Field is Fairfield, one of the supply depots of the Air Corps.

Dayton also holds the distinction of being one of the few cities to be protected from floods, by dams. These were the outgrowth of a flood in 1913 which submerged the city at a depth of 5 to 20 feet of water. The dams, at a cost of $32,000,000 were built a few miles outside of the city on all feeder streams of the Great Miami River above Dayton.

With these points of interest, Dayton offers itself to you as a convention city beyond reproach.

Advertising Campaign

With regard to the campaign now on for more advertising in the REVIEW, the question is repeatedly asked when we are trying to sell advertising — how does a buyer of advertising know what he is getting for his money, whether it is paying him to advertise in a particular periodical? There is only one way by which he can know and that is when people who are interested in his product tell him either by letter or in conversation with his representative that they noticed his advertisement in such and such a paper. That is where the members of this society have fallen down in the past.

You know and we know that the members of the A.E.S. read the REVIEW carefully, not only the papers, notices etc. but also the advertisements. If you don't believe it, talk to some other member about the last issue. You'll be surprised. You'll find he has covered it quite thoroughly.

This being so why is it that you members are so lax in letting advertisers know that you saw their products advertised in the REVIEW? Is it that you dont realize the benefits that advertising has brought us? If so, read the following carefully.

To the income from advertising in the REVIEW more than to any other one thing can be ascribed the rapid strides your society has made in the past few years. It has put us on our feet financially. It has provided us with a full time secretary to do the heavy work. It has made it possible for each one of you to receive a copy of each year's Proceedings (this year especially, a book well worth having).

Lest anyone question that advertising has made this possible consider that it has cost between twenty-five hundred and three thousand dollars to put the Proceedings out this year. Then consider that we have about twenty-one hundred members and that the additional Per Capita Tax of sixty cents provided for this furnished at most twelve to thirteen hundred dollars. Where did the rest come from? It came from the sale of advertising.

Advertising in the REVIEW has done all of this and it will

still do much more for you if you fellows will do your part. For several years it has been felt that this society should put out for its members a handbook on plating. This is something that is really needed and we have men in this society competent to and willing to contribute their time to such an undertaking. The "fly in the ointment" is the cost, several thousand dollars at least. However, you do your part and even this is not beyond the bounds of what you may expect. Your officers are doing and have done their part in the years past but they can't do it alone. You do your part. You will benefit.

What is your part? It is to see that every advertiser who advertises in the REVIEW and in whose product you are interested knows that you saw his advertisement in the REVIEW. Tell him where you saw the advertisement. Then you have done your part. You have helped the REVIEW, the advertiser and yourself.

Do this not once but every time you see anything of interest to you advertised in the REVIEW. We are thinking not only of the advertisements in this issue, but also of the many advertisers in the many issues of the REVIEW yet to come.

Do your part. Make "Mention the REVIEW" your motto. You'll be pleased at the results.

The Educational Committee of the 1939 Convention wishes to express its appreciation to Florence K. Marquardt for the excellent reporting, editing and compiling of the papers presented at Asbury Park. The "make-up" of the Proceedings excels that of all previous editions. It is a notable contribution to electroplating libraries.

The committee feels that the work of Florence Marquardt has placed the crown of success on the educational program.

GEORGE B. HOGABOOM, *Chairman*
Educational Committee 1939 Convention

COPIES OF THE CONVENTION PROCEEDINGS

The bound volume of the 1939 Convention Proceedings have been shipped to all the branch Secretaries.

Non-members of the Society can purchase copies by writing to the Executive Secretary — 93 Oak Grove Avenue, Springfield, Mass. The price is $5.00.

There will be a meeting of the A.E.S. Research Committee on Friday, October 13th at the Hotel Pennsylvania, New York, at 9:30 A. M. All those who are interested are urged to attend this meeting.

There will also be a meeting of the Joint Committee of the A.E.S. and A.S.T.M. at the same place and time on Saturday, October 14 to which all those interested are also invited.

It is to be hoped that there will be a good attendance at these meetings as there are matters of importance to this work to be discussed.

The Finishing *of* Die Cast Products

CONSISTING of a brief treatise as to their contents, their manufacture, polishing and buffing, cleaning and plating procedure.

Compiled and Read by
OWEN T. TOWNER
CINCINNATI BRANCH

We all know that the plating of die castings has given more than one plater a headache, so in this paper I am going to try and make the problem a little clearer to the average plater as to what the requirements are for a satisfactory finish on this class of product as I have found them in my experience.

There are three essential factors to be considered in producing a nickel finish on zinc base die castings of high quality, which are subsequently going to be chrome plated.

First — The casting and material from which it is made.

Second — The preliminary finishing and machining of the casting.

Third — The cleaning and plating of the casting.

The most popular casting of today is known as S.A.E. 921 — the composition of which is as follows:

	Positive — Aluminum	3.5 to 4.5	8.22
	Positive — Copper	2.5 to 3.5	
	Variable — Magnesium	.02 to .12)	
	Positive — Zinc		91.64
Impurities	Negative — Iron	.10	.14
	Negative — Lead	.01	
	Negative — Cadmium	.005	
	Negative — Tin	.005	
	Total other impurities	.02	

The only large variation would be in the magnesium content.

Now with a good metal with which to start, the die caster must produce a casting with less surface porosity, a deeper surface density, fewer large air pockets, better trimming of the castings, and

fewer blemished or slightly blemished castings. This is a large order, but some of the shops are making marked progress, and are able to secure castings of fifteen to twenty pounds with less porosity than we found in two or three pound castings of a few years ago. Methods and processes of arriving at the above will be left to the die casting shop to work out. However, improvements in the art of die casting during the past few years have been outstanding. Progress has been made in many directions tending to reduce the cast of die castings as well as to open up new fields of application. The development of larger die castings has made substantial progress, and no better illustration of this fact can be given than to refer you to the present day automobile radiator grilles, one style in which there are over 1200 square holes 5/8″ in diameter that are cast in a grille which must be free from any surface imperfections, a feat considered to be in the realm of the impossible a few years ago. The size limitation to die castings has been definitely removed and during the past two years it has been demonstrated that there is no limit as to how large a die casting can be made.

One of the outstanding achievements in the die casting industry during the past year is the definite recognition and use of magnesium as a die casting material. The use of magnesium die castings has passed from the experimental to the practical stage during the past year and progressive manufacturers throughout the country are checking to see where these die castings can be applied in their operations. Developments have indicated the possibility of producing die castings with thinner wall sections than heretofore deemed possible. This will tend to place die casting in a more favorable position when compared with other methods of manufacture.

There was an exhaustive study of the die casting industry conducted over Europe in 1936, and no better understanding of the progress made in this country can be had than by comparing it with European practice. American die casting excels in all phases. We produce better castings and produce them at higher speed, with resultant lower costs.

This progress will continue along the lines outlined above, and it is safe to predict that the die casting industry is at the beginning of the most important era in its history.

Now, after the castings reach the polishing department, the first step should be a 100% visual inspection for blemishes, cold shots and porosity. Castings that are held to definite dimensional tolerances will, of course, require such inspection as is necessary to keep within the desired limits. It is important to hold to dimension, or some one that is assembling the job, will apply a file or drill a new hole, and in a short time the part comes back because it has corroded. Castings with surface porosity should be sent back to the casting plant, and not polished to eliminate the surface defects. Likewise, damaged castings should not be polished to eliminate the defects.

The good casting should be polished and buffed without going to too much depth in the dense outer surface of the casting, which is often referred to as the surface skin. The methods of obtaining a highly buffed casting are known by experienced men. It is the importance of retaining that surface density that should be kept in mind.

Die castings must be freed of parting fins and gate stubs. This is usually accomplished by specially constructed trimming dies or by grinding with the usual felt or cloth wheel to which is glued 180-220 mesh emery abrasive. In most cases where plating is necessary, the dies from which the casting originates are so designed as to produce castings requiring very little trimming or grinding. Often a buffing with a rag wheel is all that is necessary before plating. It is obvious that the amount of work done on the casting before plating will to a large extent govern its appearance when finished.

Buffing is best done with tripoli on the ordinary loose stitched wheel, not too closely stitched however, and I would recommend 74-82 count sewed $\frac{1}{2}''$ Circle. It is essential that the material or composition used be of the free cutting grade, as excess pressure results in dragging and waviness of surface. Satisfactory coloring can be done with cloth wheels using a dry, soft or fine grained

compound, as excess grease makes cleaning difficult. It should be pointed out that nickel, which is the most satisfactory coat in most respects, does not cover defects in the base metal, and chromium serves to greatly magnify them, therefore, the buffing operation must be satisfactory. Zinc buffs easily, and ordinary care will produce a good surface.

The outer surface of a die casting usually presents the denser surface of plating. Hence, grinding which tends to cut through this outer skin should be avoided so far as possible. A peripheral speed of 5000 to 6000 feet per minute seems best for this material which would mean 300 spindle speed for 4″ to 6″ Buff or wheel, or 2000 spindle speed for 10″ to 12″ wheel or Buff approximately. Higher speeds have a tendency to cause dragging, warping and waviness.

Plated coatings or organic finishes applied to uncleaned zinc surfaces will be found to be very poorly adherent.

The surface must be free from grease, dirt, and reaction products from the cleaner, if satisfactory adhesion is to be obtained. Such cleaning may be accomplished in two ways. First — organic solvents and second by Alkaline grease removers.

A number of organic solvents are available of which Trichlorethyline seems, at the present time, to be the most attractive. It is recommended that you consult the suppliers of equipment and solvents for detailed information on their use. It may be pointed out in connection with the use of solvents that where vapor cleaning or vapor rinsing is used the last traces of solvent to dry will leave on the surface of the articles a thin film of grease. Even when vapor rinsing is employed the surface of the object may contain a film of zinc oxide developed during the buffing operation. It is strongly urged, therefore, that solvent cleaning be always followed by an alkaline cleaning treatment and acid dip.

The use of strong alkalies or of cyanides is not to be encouraged since they cause the formation of discolored films of alkaline zinc salts. Such films greatly reduce the chances of obtaining perfect adhesion of the primary coat. No cleaner which strongly discolors the zinc should be used. Of the numerous non-proprietary

cleaners which have been systematically investigated, the following is most satisfactory after degreasing. It cleans thoroughly without discoloring the zinc, when properly used; Trisodium phosphate (na_3po_4) 6 ounces per gal, (45 grams per liter). This solution is used boiling hot as an electric cleaner with the article as the cathode and with sufficient current to cause gassing. This treatment will completely remove in a short time, the grease normally present after coloring with a dry compound. Recessed articles are often difficult to free from grease. The use of a solvent type of cleaner prior to alkaline cleaning is suggested in such cases.

The cleaning solution may be removed from any minute holes or crevices in the surface of the article, by alternate rinsing in hot and then cold water. The use of a cold water rinse immediately following alkaline cleaning is not advisable since the solubility of the alkaline zinc salts is reduced by the change in temperature and the problem of removing them is complicated, and may cause defective plating.

Laboratory experiments and difficulties encountered in commercial plating plants have demonstrated that the overcleaning of zinc may be as much a cause of difficulty with peeling as undercleaning. If good adhesion is not obtained in reasonable cleaning time, the cleaner is at fault, and extension of time to longer periods will result in trouble. It may further be commented that much difficulty develops from the attempt to make a cleaner last too long. The cost of fresh cleaner is small in comparison with the value of work which may be spoiled.

It has already been emphasized that perfect adhesion can only be obtained by completely removing grease by using a proper cleaner. It is equally important to remove any film of Alkaline salts left by the cleaner through the use of an acid dip. By far the greatest cause of peeling lies in failure to provide perfectly cleaned surfaces. A dip continued until the surface has started to become matted in a cold solution of 5 to 10 per cent Hydrochloric acid, will remove the film produced by the cleaner. A thorough rinse should follow this dip in order to prevent the unbalancing of the plating bath by the introduction of excess Hydrochloric acid.

Excessive treatment in the acid dip may have an undesirable effect on the coating adhesion. The dip should react in a very few seconds, and should not be continued for any longer time than that necessary to start a vigorous evolution of gas.

There is a direct relation between thickness of coating and service life. The following figures may be given for the minimum thickness of coating which will give satisfactory service under various conditions.

For use outdoors — not less than .0005 and preferable between .00075 and .001.

For mild use indoor use — not less than .0003.

For indoor use — where conditions permit condensation on surface — same coating as for outdoor exposure.

Coatings up to .0005 are best produced by the deposition of nickel alone. Commercial practice on heavier deposits follow three main systems.

\# 1 — Nickel direct.

\# 2 — Copper — Nickel

\# 3 — Nickel — Copper — Nickel

Descriptions of these systems will follow.

Of the methods to be given, I prefer that of nickel direct for a number of reasons.

First — Nickel does not yield colored corrosion spots on products. The advantage which zinc has in being a white metal is therefore retained by confining the plated coating under the chromium to nickel.

Second — Nickel does not diffuse into zinc to form brittle alloy layers.

Third — The avoidance of blistering with nickel deposits offers a minimum of rejects.

Fourth — Measurement of thickness of coating is simplified when only one type of deposit is present.

Nickel will deposit as a black sponge on zinc by simple immersion, if no current is applied. This is due to the position occupied by zinc in the electro-chemical series in relation to nickel,

and makes the procedure of depositing nickel on zinc somewhat different from that employed in nickel plating brass or steel.

Satisfactory plating of nickel on zinc can be accomplished by the simple expedient of repressing the ionization of the nickel salts by the addition of Sodium sulphate or of Sodium citrate. While the citrate bath has been used commercially with some success, the higher efficiency, greater throwing power, and greater ease of maintaining the sulphate bath seem to render it the more desirable. Practically all direct plating of nickel on zinc today is being carried out in the sodium sulphate type of solution.

The following solution has been used commercially for several years on *plain* design of die castings:

Nickel Sulphate 10 ozs.
Annhydrous Sod. Sulphate 10 ozs.
Ammonium chloride 2 ozs.
Boric Acid 2 ozs.

Operating details for this solution are as follows:

pH. should be held to 5.3 and 5.7 Electrometric
5.8 and 6.2 Colormetric

The anode area should be controlled to minimize pH changes, which should be checked daily, and adjustments made by the addition of Ammonium Hydroxide or Sulphuric acid as needed. Under best operating conditions, this solution will tend slowly to become Alkaline.

Temperature 70 to 80 Degrees Fhr.

Below 70° Fhr. the plate will show cracking, be hard and brittle.

Above 85° Fhr. will tend to cause the formation of black streaks in recesses.

The prescribed nickel sulphate corresponds to about 2 ounces per gallon of nickel calculated as nickel. It can be higher, and no harm will result up to 3 oz. metallic nickel, and does not increase in use.

The amount of Sodium sulphate present in solution should be regulated to suit the *complexity* of the articles to be plated. Simple shapes may require not more than 10 ounces per gallon. More

complicated shapes may require the presence of 15 ounces per gallon or more. Some commercial platers add as high as 30 ounces per gallon. In general the Sodium Sulphate content should be the lowest possible for the articles to be plated.

When the solution is made up according to the formula, the bath should be operated at between 12 to 20 amp. per square foot. The maximum current density will be determined by the tendency of the deposits to burn. In the presence of very high Sodium sulphate concentrations, burning may develop at current densities lower than 20 amp. per square foot. If streaking occurs at the maximum current density purification of the solution may be necessary.

Agitation reduces porosity and permits the use of somewhat higher current densities. With certain shapes, agitation will be found absolutely necessary for successful plating.

Like all other nickel solutions this bath will at times develop a tendency towards pitting. This is usually an indication that foreign matter is present. A temporary cure can be effected by adding hydrogen Peroxide or Sodium Perborate to the solution. Permanent freedom from pitting can only be obtained by continuous filtration and scrupulous care in avoiding the presence of foreign material in the solution. Pitting may on occasion develop from faulty cleaning. A somewhat more concentrated solution permitting the use of higher current densities has been developed. This solution has been used commercially with entire success. The formula is as follows: Nickel sulphate 15 ounces, Annhydrous Sodium Sulphate 15 ounces, Ammonium Chloride 5 ounces, Boric Acid 2 ounces.

Operating details will follow.

pH. should be kept between 4.9 and 5.4 Electrometric or 5.4 to 5.9 Colormetric by means of additions of *Sodium Hydroxide* or *Hydrochloric Acid*. Ammonium Hydroxide and Sulphuric Acid should not be used as the solution is nearly saturated with respect to Nickel Ammonium Sulphate by high content of Ammonium Chloride.

The more concentrated solution permits the use of somewhat

higher current densities which in turn permit the use of higher temperatures of operation which may be reflected in slightly softer deposits. The minimum safe temperature is 75° Fhr. and the maximum for bright plate is 87° Fhr.

Nickel content corresponds to 3 ounces per gallon as metallic nickel. Any large increase in nickel content may result in crystallization of double nickel salts from solution.

The Sodium sulphate content should be regulated as for the 2 ounces (nickel content) solution. In general, somewhat higher Sodium sulphate contents will be required in this type of solution.

Current densities in this solution are somewhat higher permitting the use of a range from 24 amp. per square foot to 36 amps. per square foot. Agitation and pitting are regulated the same as in #1 solution.

Either of these two solutions can be used to produce deposits up to about .0005 in thickness. If the attempt is made to furnish the heavier coatings required for still better outdoor service life, a tendency toward cracking will be noted. While the degree of this effect can be controlled to some extent by proper operation of the solutions, other methods will be required in most cases.

Properly formulated warm nickel solutions may be operated at high current densities and will produce a softer type of deposit which, while not entirely free from cracking under certain conditions, will nevertheless be acceptable. While such solutions cannot be used directly on zinc, advantage may be taken of their desirable characteristics by the application of a multiple nickel coating. This method consists essentially of depositing on the zinc articles, from either of the two above cold solutions already described, a coating of nickel approximately .0003, following which the articles are thoroughly rinsed in cold water and placed in the warm solution for completion of the plating to the required thickness.

The multiple nickel method may be used on any work *on which it is possible to produce a satisfactory strike coating in the sodium sulphate type of solution.* Any warm nickel solution capable of producing soft deposit may be used such as $NiSo_4$ 20 ounces per

gallon, Ammonium chloride 4 ounces per gallon, Boric Acid 2 ounces per gallon.

The pH should be from 5.5 to 5.8. High pH will cause cracking and peeling while lower pH will tend to increase the attack of solution on exposed parts of the base metal.

Temperature should be between 105° Fhr. to 115° Fhr. Lower temperature will not permit the deposition of soft nickel.

The current density should under no circumstances fall below 40 amp. per square foot, and should preferably be maintained at 60 amp. per square foot or higher. Lower amperage will cause the solution to become contaminated more quickly. These current densities are similar to those required for Chromium plating, and suitable generator and Rheostat capacity should be available, otherwise do not attempt to use this process. I mention this fact just to guide you in your calculations. Agitation should be used. Like all warm solutions, new baths of this composition may develop an exaggerated type of pitting.

This condition can be readily overcome by the addition of Hydrogen Peroxide. Sodium perborate should never be used for the reasons given below.

Sodium salts should not be permitted to enter this solution. When the solution is pure, very high current densities can be employed without burning. The presence of sodium salts very definitely restricts the operation to low current densities, which not only do not utilize the full production capacity of the solution, but also permit excessive zinc pick-up. For those reasons, the rinsing between nickel tanks should be thorough, sodium perborate should not be used to prevent pitting, and additions of alkali to adjust pH should be made with *Ammonium Hydroxide*, rather than Sodium Hydroxide.

COMMENTS ON OPERATION CYCLE

The strike coating must be adequate to protect the zinc base from the subsequently used warm solution. For simple shapes, five minutes at 25 amp. should be sufficient, but for more complicated shapes, a ten minute deposit would be necessary.

In the interval between the two nickel tanks, the articles should not be allowed to dry. If drying does occur, poor adhesion of the second coat will result. The use of a cold water rinse will minimize the danger of this happening.

It is advisable to rotate the work being plated so that a load of complicated shapes, which accelerate zinc pickup is followed by several loads of simple shapes on which more zinc will plate out than is dissolved. This practice tends to hold the zinc content of the warm solution at a level which does not harm the quality or appearance of the deposit.

Copper Nickel deposits

While the system of plating nickel direct has a great many advantages, good results have also been obtained commercially by plating with copper nickel deposits totaling .001 in thickness.

In this system of plating the work is cleaned as described in the earlier part of this paper, and a coating of copper is applied to a thickness of .0003 from a cyanide copper of this ratio. Sodium Cyanide 5 ounces per gallon, Copper cyanide 4 ounces per gallon, Sodium Bicarbonate 1 ounce per gallon and Sodium Bisulphite $\frac{1}{4}$ ounce per gallon. Temperature from 70 to 110° Fhr. and at 10 to 15 amp. per square foot.

The nickel coat may be applied from the warm solution noted above.

The Copper-nickel system of plating is adapted to the production of heavy deposits. Its use is not advocated for deposits of .0005 or less.

The deposit of copper should not be less than .0003 in order to avoid complete absorption by the zinc base, and to provide protection of the zinc base from attack by the warm nickel. The copper layer here performs the same function as the primary coat of Sulphate solution in the other method. However, the coating from the warm nickel should not be less than .0003 for outdoor use. Thinner deposits will readily permit the seepage through the pores of copper salts which will stain the surface with an unsightly brown film.

Cyanide solutions, particularly when used on Zinc, may at

times produce deposits which blister readily. This seems to be related in some way to the cleaning practice used and often can be minimized by care in avoiding over cleaning. The tendency to overlook some of the factors of cleaning when using the copper-nickel method in comparison to the straight nickel method are some of the causes of this blistering condition.

Zinc metal absorbs copper deposits even at room temperature. The rate of absorption is very rapid for thin flash deposits, but becomes slower as the amount of copper is increased. Deposits of copper of .0003 thick should not be completely absorbed during the lifetime of a plated part, although diffusion is taking place continually, and it is much safer to apply a heavier coating if for outdoor use, or humid exposure.

After some period of exposure, it will be found that a zone of diffusion alloys has formed between the copper layer and the zinc base. Certain of these alloys are brittle and may fail under stress causing separation of the plate from the base metal.

A few years ago there was a triple plate method employed in the plating of die castings, known as the nickel-copper-nickel method for heavier deposits, which would give coatings from .0075 to .001 or over of combined plate, where cracking of deposits became troublesome. We have already discussed the multiple nickel coatings. The system of Nickel-Copper-Nickel Cycle is as follows:

Clean as described before. Plate .0003 in Sodium Sulphate Nickel bath. Plate .0004 in Acid copper bath of regular standard. 24 ounces Copper Sulphate, 6 ounces Sulphuric per gallon.

Color buff copper coat and clean.

Plate .0004 in warm nickel solution. The Buffing operation is *not essential* if the two primary plates are sufficiently smooth to make coloring of the final nickel readily accomplished.

The primary coat of nickel should be at least .0002 in order to prevent the attack on the zinc from the acid copper solution. The final nickel should not be less than .0003 thick to prevent copper stains when exposed outdoors and can be built up by longer plating to any desired thickness.

Nickel solutions used on zinc tend to accumulate zinc in solu-

tion. When the amount present becomes sufficiently great, streaking will occur as a result of the plating of nickel-zinc alloys of relatively high zinc content. In the case of the cold sodium Sulphate bath (room temperature), this difficulty arises when 0.3 grams per liter of zinc is present.

In the warm nickel solution, approximately 1 gram per liter of zinc must be present before streaking develops. Definite brightening and some tendency toward cracking are observed, however, when the amount of zinc in this bath greatly exceeds 0.3 grams per liter. Several methods are available by which to remove excess zinc and bring the solution back to a workable condition. The basic Nickel carbonate treatment seems to be the more worth while, so I will review this method.

Raise the pH until Nickel Hydroxide begins to precipitate, say about 6.8 or 7 otherwise true neutral. Heat the solution to about 150° Fhr. and add about 1/3 ounce of basic Nickel Carbonate, freshly prepared. A heavy white precipitate should form. If no precipitate is evident, add more basic Nickel carbonate until it does form. If the solution is to be used cold, allow to cool overnight, then filter. This completed, adjust pH and nickel content to desired points. Should you experience excessive gassing, work heavily until this condition disappears.

Basic Nickel carbonate may be prepared by adding 1 part Sodium carbonate to 7 parts of nickel sulphate in just sufficient water to dissolve the nickel sulphate.

Then there is the Ammonia Treatment which would apply to the warm nickel. Heat the bath to 140° Fhr. and add ammonia Hydroxide until a pH of 6.8 is reached. Allow to settle by standing overnight, but not below the temperature at which it is used, and filter, adjust pH to operating point and check nickel metal content. This treatment in either case will remove all of the zinc iron or percentage of cadmium which may have accumulated.

The question of how best to handle the occasional rejects is open to much discussion. I prefer the method of Electric current reversed. This solution is composed of 70% Sulphuric Acid, 30% water; Baumé not to be lower than 48°. As this solution contracts

moisture from the atmosphere, it is well to check often. It can be contained in a plain Iron tank, as long as you do not allow dilution below the figure stated.

The latter methods, we will say in the last four years, have discarded the old Cyanide Copper bath and substituted the Rochelle Salts bath. This is a decided improvement in respect to fine grain deposits, and with the addition of 1/8 ounce per gallon of Sodium Thiosulphate, are able to obtain deposits under agitation of good enough surface plate of .0003 to plate the nickel direct, without buffing, in the watts nickel, which corresponds to the warm nickel mentioned in this paper, and get a .001 Multiple plate. However, there is in use in a great many plants an intermediate dip of 5 per cent sulphuric acid, after coming out of the copper solution, to remove any trace of cyanide in the recesses. It may be in order to give the Watts nickel as it is used, also the Rochelle Salts Copper bath.

Watts Nickel consists of	35 ozs. Nickel Sulphate 4 ozs. Boric Acid 4 ozs. Sodium Chloride
Adjust pH by Ammonia and	pH 5.8
Sulphuric Acid	Temp. 100 to 115 Amp. per square foot 25 Anodes — Depolorized Bagged. No Agitation
Rochelle Copper consists of	3½ ozs. Copper Cyanide 5¾ ozs. Sodium Cyanide 8 ozs. Rochelle Salts
Adjust pH higher by Caustic	1½ ozs. Sodium Carbonate
Soda - - lower by Tartaric Acid	3 ozs. Caustic Soda 1/8 ozs. Sodium Thiosulphate
(Use Soda in preference to Cyanide)	pH 10.5 Temp. 140° Fhr.

The chromium plating governs the pH of the nickel solutions used in this process extensively. If you allow the Sodium Sulphate Nickel bath to exceed the point of 6.0, you will have passivity to a great extent, and much difficulty in covering. It is well to adhere to close control on all phases of this procedure as it means less trouble for the man responsible for the plating and less cost to produce.

BARREL FINISHING AND NICKEL PLATING ON ZINC

Factors affecting the successful barrel plating of zinc with nickel are — the preliminary preparation of the surface of the fabricated zinc product, the composition of and the acidity or pH of the Nickel plating solution, and whether or not it is copper plated previous to nickel plating. The steps employed in the production of small parts nickel plated by the barrel method consist of dry grinding, cleaning, copper plating, ball burnishing, cleaning and nickel plating.

We will take each method and elaborate more fully. The dry grinding method employed in the preliminary preparation of the zinc surface consists of charging the parts with a mixture of maple-wood sawdust and powdered pumice into a horizontal barrel. By rotating the barrel at 30 R.P.M. for a period of 2 hours, the grease from the parts combines with the sawdust and pumice. This operation removes burrs and also oxide film, also slightly roughens the zinc surface.

The cleaning operation next employed is accomplished in baskets with a weak alkaline solution, namely Na_2CO_3 4 ounces per gallon, (Sodium Carbonate) Na_3PO_4 4 ozs. per gallon (Trisodium Phosphate), NaOH 2 ozs. per gallon (Sodium Hydroxide).

After rinsing in clear cold water, a cyanide copper of the following composition is employed for copper plating, CuCN 3 ozs. per gallon (Copper Cyanide), NaKc4H404 6 ozs. (Rochelle Salts), NaCn 4.5 ozs. per gallon (Sodium Cyanide). The articles should be plated for 30 minutes at a temperature for solution 140 to 170 degrees Fhr. with a 12 volt current of approximately 4 amp. per square foot, with a result of a deposit .0002. This thickness is of sufficient thickness to prevent diffusion of the copper into the zinc and the subsequent blistering of the nickel deposit.

The parts are next ball burnished in a ball burnishing barrel charged with suitable material to reach recesses, which consist of various shapes and sizes, and good lubricating mixture of burnishing material of non-alkaline content. Use no cyanide or sodium carbonate under any consideration.

After again cleaning in the weak cleaner and rinsing with clean cold water, the copper plated burnished zinc parts are then nickel plated in a plating barrel. The nickel plating solution employed consists of:

$NiSo47H_2O$	Nickel Sulphate	28 ozs.
$NiCl_26H_2O$	Nickel Chloride	6 ozs.
HB_3O_3	Boric Acid	2 ozs.
$NaBO_34HO_2$	Sodium Borate	1 oz.
NH_4OH	Approx. Ammonium Hydroxide	6.5 oz.

Sufficeint NH_4OH is added to the solution to obtain a pH of from 7.6 to 8.0, this value being determined by colorimetrically using Phenol red as an indicator.

After nickel plating for 1 hour at a current density of approximately 4 amp. per square foot using 8 to 12 volt with a current of from 200 to 400 amp. per load and a temperature of from 90 to 140 degrees Fhr. a nickel deposit of approximately .0002 or 1/3 of an ounce per square foot will result at the higher current density. If you use no brightener, the parts can be again ball burnished if you require a high finish.

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BBL Plating of Nickel on Zinc. By Albert Hirsch

Purification *and* Filtration *of* Plating Solutions

Presented to the Grand Rapids Branch of the American Electroplaters' Society March 9, 1939

By CHESTER W. SMITH

It is desirable to differentiate between what is accomplished by filtration and what is further accomplished by purification plus filtration. Webster defines filtration as "the act of passing a fluid through a porous mass to separate from it matter held in suspension". It is impossible therefore to remove by simple filtration materials which are in solution. Purification is also necessary.

The act of purifying involves throwing obnoxious and interfering elements out of solution, and separating the main solution from them. Although the dissolved materials classified as impurities are usually present in small quantities in comparison to the essential elements of the solution, such small quantities of some of the impurities are permissable that their complete removal without loss of the desirable elements of the solution must be our aim.

It would be impossible to cover all types of plating solution in this brief paper, and it is my desire only to point out some approved methods of conducting purifications and means of filtering out suspended materials and precipitates as completely as possible.

In Nickel Plating solutions the chief impurities which are objectionable and cause improper deposits of nickel are: iron, copper, zinc, chromium, and certain organic materials.

By careful control of pH most of these may be precipitated out of solution. High temperature seems to aid in oxidizing such elements as iron and copper to their higher valence where they form insoluble compounds. Oxidizing reagents such as hydrogen peroxide and potassium permanganate are used for this purpose in dull nickel solutions only.

Ferric iron will start to precipitate at a pH of 4.7, cupric copper at 5.8 to 6.0, zinc at 5.8 to 6.0, and chromous chromium at 6.0 to 6.2. These pH figures are all on the basis of quinhydrone

measurements. Such metals are usually precipitated as hydroxides or carbonates in their ranges.

Organic materials such as emulsified oil, saponified fatty acids, proteins, starch, and some organic addition agents can be completely removed by treatment with activated carbon. The completeness of removal depends upon the proper conditions of pH and temperature and the adsorbing powers of the particular charcoal or carbon used.

An approved procedure for precipitating the above-mentioned impurities is as follows:

1. Heat solution to 160-180°F.
2. Add Nickel Carbonate to raise pH to 5.6-5.8 (four pounds of fresh basic Nickel Carbonate per hundred gallons of solution).
3. Raise pH to 6.2 with chemical lime. (One-fourth to one-half pound per hundred gallons).
4. Agitate solution by stirring for about an hour.

The addition of hydrogen peroxide or permanganate can be made in the case of dull nickel solutions to speed the oxidation of iron and copper. In such cases prolonged stirring is unnecessary. The solution is allowed to settle and cool off. Filtration will be facilitated if the precipitate is allowed to settle. This process should remove all iron, copper, and zinc, if properly carried out.

Nickel Carbonate is used for the main precipitating agent rather than Caustic Soda, Soda Ash, or Lime, because it introduces no foreign salts such as Sodium, Calcium, or Magnesium compounds. The carbonate of the Nickel Carbonate will be decomposed when the pH is lowered for operation. Most high metal content solutions, whether bright or dull, are operated between 1.5 and 5.0 (quinhydrone) which will decompose any carbonate present and liberate carbon dioxide.

Sodium is objectionable as it forms sodium sulphate which reduces limiting current densities and affects adversely the structure of the nickel deposit. Sodium also affects the action of some organic bright plating addition agents.

The calcium and magnesium resulting from the use of large quantities of lime will be to a degree dissolved as chlorides in the operating pH ranges and affect the nickel deposits similarly to sodium. In solutions of low pH these are converted to sulphates which are insoluble and contribute to roughness.

Chromium may be removed if it is reduced to the chromous or trivalent condition and filtered out as chromous hydroxide at a pH of 6.0 to 6.2 (quinhydrone). Ferrous sulphate is used as a reducing agent. This is added to the solution in quantities of one to two pounds per hundred gallons (depending on quantity of reducible elements and hexavalent chromium present), before the pH is raised with Nickel Carbonate and after the solution has been heated. In this way chromium, iron, copper, and zinc are all removed at the same time when the solution is filtered.

Organic elements are adsorbed by activated charcoal usually at a low pH. Charcoals have different adsorption efficiencies depending on the particular type used. The quantity of charcoal used depends on the amount of organic material to be removed. Inasmuch as it is difficult to determine the exact amount of organic material present, it is usually advisable to use ample quantities of charcoal. Usually three to eight pounds per hundred gallons of solution will cover the possible contamination present. This should be added to the solution at the recommended pH for adsorption. This is stirred for a period to allow the charcoal to adsorb dissolved or emulsified material, then filtered carefully using a precoat of filter aid.

The elimination of both organic and metallic impurities may be accomplished with one filtration by first adsorbing with charcoal at a low pH (1.5-2.5, quinhydrone) and reacting by stirring, and then raising the pH and carrying out a high pH purification as I described earlier. Once the charcoal has adsorbed the organic impurities at a low pH, the pH may be raised without affecting the adsorption.

Plating out of metallic impurities such as iron, copper, zinc, and lead may also be accomplished at low current densities. The pH of the nickel solution is lowered to a pH of 2 (quinhydrone) and electrolyzed for as long as 200 ampere hours per hundred gallons of solution at a current density between two and five amperes per square foot. This purification is based on the decomposition voltage for these metals in a nickel solution.

Displacement of metallic impurities in solution by the introduction of finely divided nickel metal is also effective.

The precipitation and filtration method is by far the most complete and usually the most rapid if facilities are available.

In cyanide copper and brass plating solutions the chief interfering elements which can be removed by purification are carbonates, oils, saponified materials. Lead may also be partially removed.

Carbonates may be precipitated by Calcium Sulphate or crystalized out at low temperature. The precipitate of Calcium Carbonate should be filtered out.

Oils and soap may be adsorbed with activated charcoal. A grade effective at high pH should be used and then filtered out using filter aid as a precoat on filter.

Lead can be partially precipitated by the limited addition of Sodium Thiosulphate (Hypo). The lead is precipitated as lead thiosulphate. Following the addition of "hypo" the solution should be filtered as roughness is often encountered.

In Cadmium plating solution carbonates are also found objectionable. The presence of carbonates in cyanide solutions is accompanied by lower cathode efficiencies with some additional undesirable effects on the cathode deposit. Carbonates are removed in a manner similar to those in copper cyanide and brass plating solutions.

Lead and copper are two very objectionable impurities, especially where a lustrous cadmium is desired. Due to their placement in the electromotive series these metals may be displaced from solution by treating the solution with finely divided cadmium metal dust. The solution is then filtered free of suspended metal.

In Cyanide Zinc plating solutions carbonates do not have as pronouncedly adverse an effect as in other cyanide plating solutions. Therefore they are not considered as objectionable as some other impurities such as cadmium, copper, lead, and mercury, which have a decidedly adverse effect on the appearance and the corrosion resistance of the cathode deposit. Cadmium, lead, and mercury may be precipitated as sulphides and removed by filtration. Sodium Sulphide may be used as the precipitating agent. The addition of sulphides to Cyanide Zinc solutions is covered by patents pending.

Copper as well as the above-mentioned impurities can be removed by treatment with C. P. zinc dust. One to two pounds of zinc dust per hundred gallons of solution well stirred into the solu-

tion will remove interfering metallic elements. This treatment should be followed by filtration to insure complete permanent removal.

Filtration:

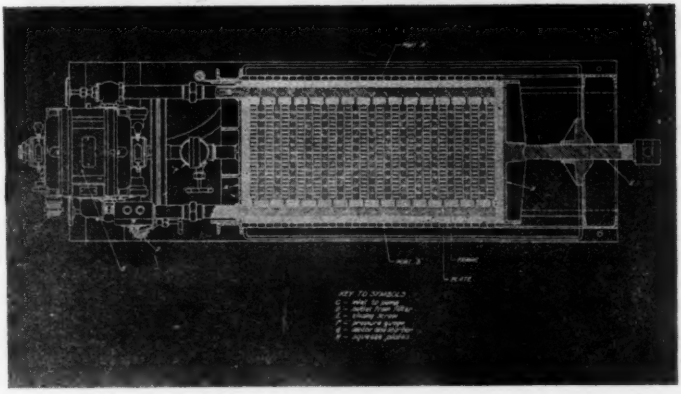
In order to completely purify a solution the precipitated and suspended materials must be filtered out. There are several different types of filters used for this purpose.

The plate and frame type press is most widely used where large volumes of plating solution are to be filtered. The construction and advantages of this type of filter will be discussed more fully.

The cell or disc type filter is in wide use for smaller requirements. This type filter is limited in its operation when it becomes necessary to remove large quantities of sludge of a character which restricts ready flow. The centrifugal pumps must be large on such presses if they are to be capable of forcing solution through, where high resistance to flow is encountered. The smaller active filtration area in relation to calculated delivery is why pressure increases quickly, due to sludge to a point where flow is materially reduced.

In order to explain more clearly the principles of the plate and frame filter press, I will use a diagram showing the cross section of a press of our manufacture which is similar in principle if not in construction to other filters of this type.

PLATE I.



The solution enters all cells almost simultaneously and passes through the filtering material, leaving the dirt on the outer surface of the filter cloth. The clear solution is collected from the cells and passes through channels formed by holes bored in the cells which are placed together. It then emerges through a single outlet pipe.

The material used in the construction of a filter press is most important. A metal such as bronze (80; 10; 10), when used in pump construction, while suitable for filtration of high pH nickel solutions, is certainly not ideal for low pH type nickel plating solutions where corrosion of the bronze results.

Nickel may be used for pump construction, but castings of nickel are hard to pour free from porosity and difficult to machine. Moreover nickel is a costly construction material.

In one case a nickel pump was used and on examination after one month's continous use in constant filtration, it was found half corroded away. This was traced to an electrical circuit where the nickel in the pump was acting on an anode in the plating solution. The answer to the problem was operation of the pump only when the solution was not being electrolyzed.

Duriron and lead make satisfactory metals from the standpoint of corrosion resistance, but extensive research on our part points to the conclusion that iron, rubber-covered, is the most satisfactory from the standpoint both of corrosion resistance and mechanical strength. Such a pump is applicable in both acid and alkaline solutions.

In alkaline and alkaline cyanide solutions iron is satisfactory.

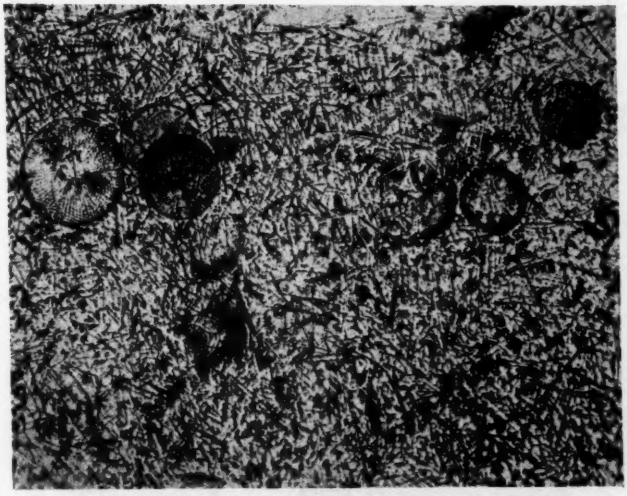
The plates and frames may be of wood construction for use in nickel filtration. However wood will deteriorate making replacement necessary. Lead is used in construction of plates and frames, but is subject to deformation. Here also rubber becomes the most adaptable if hard rubber is used over iron. However iron cells rubber covered are bulky and heavy. Our research has shown that solid rubber plates and frames are light in weight and are a satisfactory construction material.

The material used for the filtering is most important. Several factors influence the selection of the proper material for the

PLATE II.

Closely Woven Filter Cloth — 200 Diameters

PLATE III.



Super-Cel — 200 Diameters

medium of filtration. Cotton or wool cloths are most widely used. Woven wire cloth and "Fibreglas" cloths are used in some cases.

The requirements filter cloth must fill satisfactorily are:

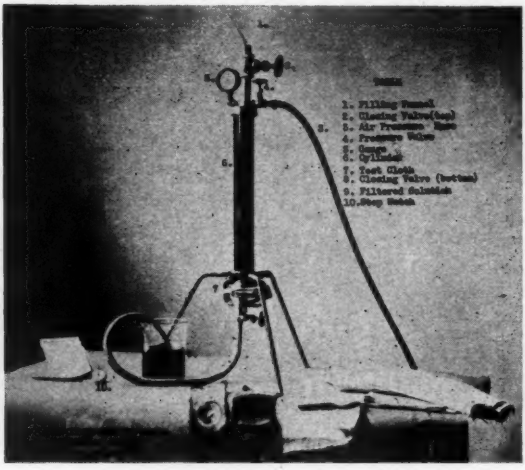
First:

The cloth must retain the particles which are to be removed. "Dirt" must be retained when the pressures rise and the fibers are stretched.

Plate II shows an average closely woven conventional weave. This type would not retain particles at high pressure.

Plate III is the same cloth with a pre-coat of "Super-Cel". This is a fine grade of diatomaceous earth which will retain particles too small for the filter cloth alone to stop. A coating with many very fine pores is formed and such a precoat will not reduce the flow to any great extent. The selection of the proper filter aid is dependent on the type of solution and the size of the particles to be filtered. Four ounces of filter aid per square foot of filter area is usually a good rule. This affords a heavy enough precoat and ample assurance that the dirt will not become embedded in the filter cloth making washing out difficult. Filter aid added throughout filtration will prevent clogging and sustain a higher flow of solution.

PLATE IV.



The second requirement of filter cloth is that it must permit a free flow of solution without too rapid increase in pressure.

Third, the cloth must possess sufficient strength of fiber to withstand high pressures without tearing.

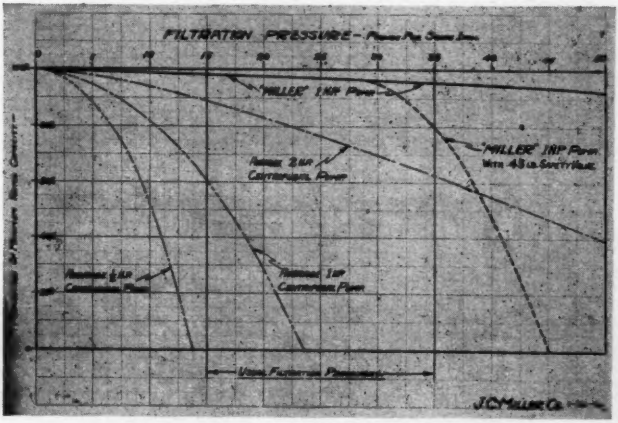
Fourth, the cloth must not be affected by the solution being filtered to such an extent that it will not fill the requirements given above.

Plate IV is the test apparatus which was used in approximately three hundred tests of various types of filter cloth, to determine satisfactory application for use on a Plate and Frame filter press. Samples of cotton, wool, and glass cloths of every make, weight, and description were tested. This piece of equipment is constructed to test with any type of plating solution, to measure flow rate at constant pressure, to determine retaining properties at any pressure, and to test the breaking or tearing point of the fabric.

It was found that many cloths did not possess the strength which is desirable for best filter use. A majority would not retain finely divided dirt such as carbon even with a precoat of four ounces "Super-Cel" per square foot of filter area and at twenty pounds per square inch pressure or above.

Characteristics of various weaves in filtration are very inter-

PLATE V.



esting. It is difficult to tell from the appearance of a fabric whether or not it will be a satisfactory filter material. From these tests the best types of cotton, wool, and glass fabrics were selected.

Special cloths were selected for nickel, acid copper, cyanide copper, zinc, and cadmium. Other special filter problems have been solved in a similar manner.

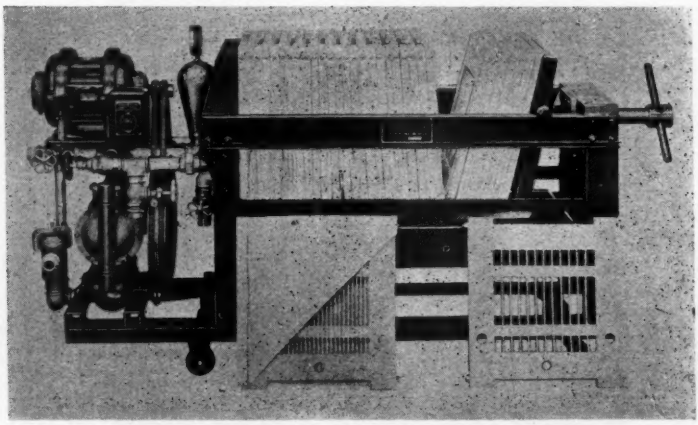
This chart shows comparative efficiencies and pressures obtainable with centrifugal and diaphram pumps. It will be seen here why strength of the filter material and efficiency of retention are important where higher pressures are obtainable.

If precipitates and dirt are removed the flow is bound to decrease, when the pressure remains constant. Therefore, to maintain a uniform flow, additional pressure is necessary to force the solution through the cake of filtered material.

The use of a positive acting diaphram pump which delivers a nearly constant volume of solution permits a smaller filtration area with a larger volume of filtered solution delivered than is possible with a similar sized press using a centrifugal pump.

Plate VI shows a high pH nickel press exposing the construction of the cake cell and filter cell. This press is equipped with a

PLATE VI.



bronze diaphram pump which delivers approximately 1000 gallons per hour of filtered solution up to forty pounds filtering pressure, at which point the automatic shut-off indicates cleaning is necessary. A similar press with iron pump and iron plates and frames and special cyanide filter cloth is used for cyanide copper, cadmium, and zinc.

PLATE VIII.

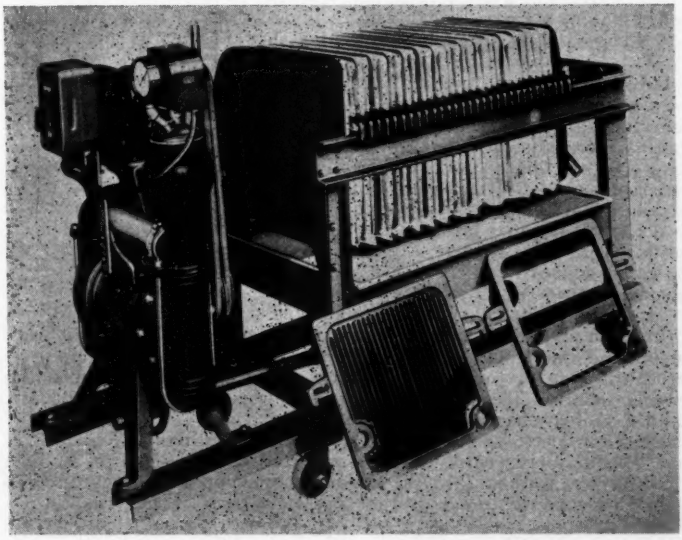


Plate VIII shows a new type of press with all rubber diaphram pump and molded rubber cells. This unit is adaptable to acid and alkaline solutions alike. Different filter cloths are used for different solutions. However, Nitric and Chromic acid solutions are excluded from this, as they of course are injurious to rubber.

Although it is obvious that impurities are not wanted and that our aim should be to prevent their ever entering the solution, in spite of care they are introduced in the process of operation. Thus the necessity of corrective measures arises. Good purification with accompanying filtration saves solutions that would otherwise be "dumped".

Here and There

Pittsburgh According to President Stanley Hedden, the first fall meeting of the branch was very successful. Mr. and Mrs. Hedden spent their vacation in the northern part of Michigan where it is still wild. At one place they had to stop their car to let a big black bear cross the road. Mr. Frank Keller, the new secretary is taking hold in good shape. We expect interesting reports from Pittsburgh Branch this year.

Milwaukee Dexter Rhodes who toiled incessantly to make the Milwaukee Convention such a success has been honored by his branch. Dexter was elected secretary in place of Robert Goodsell, who has secured a position in Iowa. Our best wishes are hereby tendered to Mr. Rhodes. Milwaukee Branch is favored indeed in having so many capable and willing workers. Under the leadership of Jack Geissman, the president, Milwaukee should go places this year.

Toledo The best meeting we have attended in Toledo was held on Thursday evening, September 7, at the Vocational School. There were over 40 present including first vice president, F. Fulforth of Philadelphia and the Executive Secretary. Previous to the meeting we visited several plants all of which were very busy, mostly on die castings. Mr. Lester Cope foreman in charge of plating at the large Dura Company's plant showed us some nice work being done on automobile parts. Nagle Bros. plant is also going strong. We were pleased to meet the four brothers who are carrying on the business since their father died a year or two ago. Mr. Nagle Senior was well known in our organization and in connection with the Master Platers Society. It was a privilege and a pleasure to meet Mr. F. W. May, Purchasing Agent for the Autolite Company, chairman of the Educational Committee of the branch. Mr. May is full of enthusiasm and says that attending the branch meetings has helped him to understand the problems and difficulties with which the platers are confronted. Mr. May gave an inspiring talk on the proposed branch activities for the coming months. The Toledo boys are enthusiastic regarding the future and started the year by electing five new members.

Visitors from Detroit were Past President and Chairman of Research, A. B. Wilson, "Mose" Cherry, Bill McCord, and T. Kirby, President of A. T. Wagner Co. We wish to thank Mr. Vic Minor the branch president who gave us his time and furnished the transportation to various parts of the city.

Mr. Wilson spoke on Research and Mr. Fulforth presented his picture on Cold Rolled Steel for Plating Purposes, which was well received as the applause at the close of his address proved.

Ross Lyons of the Hanson-Van Winkle-Munning Company of Cleveland, the hard working secretary of Cleveland Branch visited us for a few minutes, but was unable to stay for the meeting. We were pleased to greet him again.

Dayton Mr. H. C. Luechauer, Chairman of the Educational Committee of the convention met us at the station accompanied by President Goodsell who arrived earlier. We went to the National Cash Register Company's plant and were joined by the general chairman of the convention committee, Mr. Charles Conley. After being introduced to Mr. Beaver and Mr. Williams two of the plant officials, we were invited to have lunch in the Horse Shoe Room. Here sitting at the tables were approximately 150 men representing the plant management; included in this group was Colonel Deeds, the president and chairman not only of the board of directors of N.C.R., but 22 others. He gave a splendid address regarding the war hysteria and advised each one to find enough to do minding our own business here so that we will not be worrying about the happenings "over there".

After lunch Mr. E. W. Cochran foreman in charge of plating at the N.C.R.

WING YOUR WAY TO DAYTON, THE BIRTHPLACE OF AVIATION

took us through the various departments explaining the automatic polishing and plating setups which was very interesting. From here we went to the proposed Convention headquarters, the Biltmore Hotel. We heartily commend the committee's choice as this hotel seems to be all that is necessary for a convention such as ours. The hall holds over 700, there are small meeting rooms galore, a fine dining room, and all the necessary requirements that make a successful convention headquarters. In addition to the Hotel, Dayton branch has a real live wire organization to tackle the convention details. We met nearly all the committee chairmen and are well pleased with the manner in which they look forward to the days ahead. The ladies also are enthused and are planning to give their sisters from other branches a most enjoyable time when they visit Dayton next year.

Mrs. Conley and Mrs. Cochrane were appointed co-chairwomen of the ladies committee.

The meeting in the evening at the Engineers Club was presided over by Mr. Conley. President Goodsell spoke on the Research and Advertising Programs. Mr. Fulforth presented his picture on Steel. The Executive Secretary discussed the details of the 1940 convention. There were five members present from Cincinnati branch, Messrs. Towner, Adler, Gannon, the new secretary of Cincinnati branch, a member whose name we can't recall, and Mr. Fred Vogel, editor of Products Finishing, who very kindly promised to assist Mr. Wise, the Dayton branch convention publicity chairman in every way.

At the close of the regular session Mr. Conley suggested a meeting of all the Committee Chairmen with the Supreme Officers. All angles of the convention details were discussed in an informal manner. It was agreed that no time should be lost in the soliciting of papers for the educational sessions. Advertising in the convention program and the publicity were the other items receiving particular attention. This session lasted until 11.30. The ladies in the meantime were assembled in an adjoining room discussing their particular problems.

The reports of the Buffalo, Rochester, Binghamton-Syracuse, Toronto outing on Saturday have been given by eyewitnesses who were present all through the event. Summing up briefly we would say that every one had a fine time. The ball game was one of those terrible affairs. The umpire, Bill Schneider was the target all the way, but he escaped unassisted. Joe Ruff, Jerry Lux, Judson Elster, and Ray Berghold were particularly good umpire baiters. It seemed like old times seeing Bert Sage (he with the Hawvawd accent) and Bill Treadwell, both of the boys came from Boston branch recently.

Ves Gartland and Frank Kohlemeyer from Rochester and George Simmons of Binghamton formerly of "Marathon" were on the sidelines. Just as the party was starting to warm up to we were forced to catch a train so we asked Joe Ruff to lend us his car and chauffeur, Mr. Roderick McGee, to convey us to the station. We enjoyed our short stay and appreciate the fine spirit of friendship shown by the members of the combined branches.

Newark Annual outing at Vogel's Grove, Union, New Jersey, September 30.

Bethlehem Connecticut, Platers' fall outing at Bob Leather's home, Leacrest, October 7. Everyone invited.

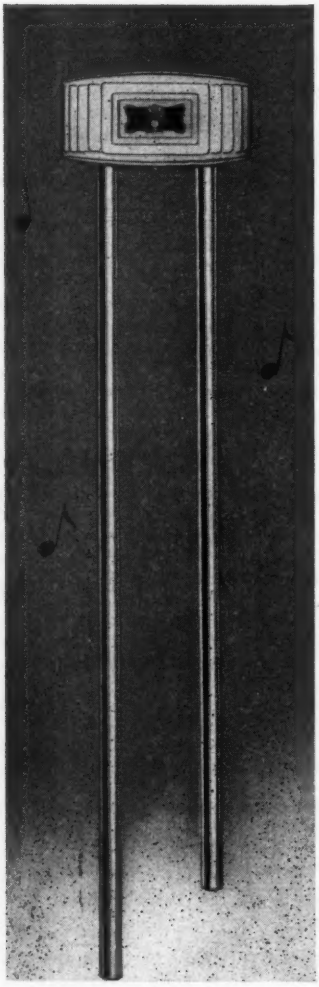
Rochester September 15th. Fall schedule of Speakers. William Schneider, E. I. duPont deNemours Company, Molybdenum Black.

October 20. Edward Rinker of the Oakite Products Co. Cleaning of Steel Preparatory to Electroplating.

November 17. LeRoy E. Sullivan of Divine Bros. Co., Utica, N.Y. Some Things about Buffs and Buffing Compounds.

WING YOUR WAY TO DAYTON, THE BIRTHPLACE OF AVIATION

Door-Bell Chimes . . . .



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Electro-Tinning*

Operation of Process and Baths Commonly Employed

*Abstracted from Publication No. 92 of the International Tin Research and Development Council, Fraser Road, Greenford, Middlesex.

THERE are a number of advantages which make the process of tinning by electro-deposition worthy of consideration as a reliable means of applying a coating of definite and uniform thickness within accurate limits. Such articles as automobile pistons, knuckle bolts, etc., are tinned and used without subsequent machining. It is possible, by the process, to build up coatings as thick as 0.125 inches. Thicknesses of 0.003 to 0.005 inches are easily attained; whereas it is difficult by hot dipping to get a thickness greater than 0.001 inches. Such heavy plating has been used to provide surfaces which form a joint without a gasket or to provide a protective coating which will be assured of exceptionally long life. Tin plating baths, and especially the sodium stannate solutions, have remarkably good throwing power and provide an excellent means of applying a uniform effective coating to complicated components after fabrication. Thin coatings can be applied by electrodeposition, which, although possessed of quite limited protective properties, provide an exceedingly economical protection for delicate metallic parts during periods of storage.

The art of depositing tin by electro-deposition has progressed to the point where it may be claimed that: (1) plating solutions may be quickly prepared from standard chemicals on the market; (2) anodes are easily obtainable; (3) Equipment is readily available (4) the process can be operated satisfactorily under ordinary factory conditions; (5) control of deposits and of the baths is simple; (6) anode and cathode efficiency can be closely balanced; (7) the baths have good throwing power and hence coatings are of uniform thickness; (8) deposits adhere well; (9) a wide range of closely controlled thickness of deposit is possible; (10) the deposits have excellent protective qualities.

STANNATE BATHS

The stannate bath in which sodium stannate is generally employed is the most widely used in both small scale and fully auto-

matic plants. It is the most useful of the "alkaline" baths and combines excellent throwing power with a smooth compact deposit throughout a range of conditions that are easily controlled and maintained in practice.

The bath is essentially a solution of sodium stannate containing a little free caustic soda; the presence of sodium stannite is detrimental and must be avoided. A preferred concentration of the various dissolved salts depends on the operating temperature and/or the cathode current densities chosen, but a normal range of composition is:

	Per Gal.
Sodium Stannate	9 to 16 oz.
Free Caustic Soda	1½ to 2½ oz.
Sodium Acetate (if desired)	2½ to 5 oz.
An initial addition of Hydrogen Peroxide or Sodium Perborate	1/16 oz.

The sodium stannate in the bath acts as a reservoir of tin which is given up to the cathode and replenished from the anode. Caustic soda is required to maintain the tin in solution without the formation of hydroxides and to ensure the proper dissolution of the anode. Sodium acetate acts as a "buffer salt" and is claimed to widen the range of conditions under which satisfactory deposits are obtained. Hydrogen and sodium perborate are added to new solutions to oxidise any traces of stannite or undesirable impurities which happen to be present in commercial sodium stannate.

Cathode current densities of from 10 to 25 amps. per square foot are in use, with 15 amps. about normal. Higher values must be accompanied by higher bath temperatures and the caustic content should be adjusted. Little saving in the time is achieved by using current densities greater than 25 amps. per square foot.

The anode current density should be about twice that used at the cathode, the anode efficiency under such conditions varying between 75 per cent. and 95 per cent. according to the current density employed. With the proper anode current density the tin is dissolved in the quadrivalent, stannate form, and the anodes are filmed with a greenish-yellowish coating. Too high or too low anode current densities will result in undesirable reaction. A six-volt source of current is usually adequate and the bath is commonly worked at 75°C.

If the free caustic content of the bath drops, there is danger of precipitation of insoluble hydroxides of tin. Since carbon dioxide from the air is absorbed into the bath to form sodium carbonate, it is advisable to check the free caustic content at least twice weekly. If excessive quantities of sodium carbonate build up in the bath, they should be removed by cooling and immersing in the bath iron or nickel gauze in the form of a tray on which large crystals of sodium carbonate decahydrate will form.

Charts have been drawn up to indicate the most suitable working conditions at various cathode current densities. For example, if it is desired to work at 15 amps. per square foot, the chart indicates a solution containing 40 to 45 grm. per litre of tin and 12½ grm. per litre of free caustic soda for working at 75°C. If, however, the temperature is to be raised to 80°C., the tin content should be 30 to 35 grm. per litre and the free caustic 10 grm. per litre.

Occasionally platers add to the bath organic agents such as lactic acid, tin resinate or resin to improve the colour of the deposit. Such additions must be made with great caution as they do not disperse readily throughout the bath and may give rise to a patchy appearance on the deposits. There is also a tendency to reduce the cathode efficiency when first added. Since it is vital that the anodes be kept filmed, and as the film will dissolve off very rapidly if the current is cut off, it is desirable to ensure that the bath works as continuously as possible. It is sometimes convenient to employ "false cathodes" such as thin sheets of pure tin, which may be used to provide a small load when there is no other work in the bath.

STANNITE BATHS

The stannous chloride-caustic potash bath, that is potassium stannite, was one of the earliest types of tin plating baths. Being low in first cost, it is still occasionally used, but the range of satisfactory working conditions is narrow and owing to the low current densities and the instability of the solution, it is used only for small and occasional jobs.

For hot operations, a typical solution contains 2 oz. per gal. stannous chloride; 8 oz. per gal. caustic potash; and 1/12 oz. per gal. glue or gelatin. For operations at room temperature, the solution may contain 6 oz. per gal. stannous chloride; 16 oz. per gal. caustic potash; and 1/12 oz. per gal. glue or gelatin.

While the action of addition agents, such as glue or gelatin, is not always satisfactory, little information is available and definite recommendations are impossible. Up to cathode current density of 5 amps. per square foot, fair deposits are possible, but at higher density, burning occurs at corners or edges with the formation of spongy growths. The voltage across the bath should be about 0.5 volt for the hot bath and still less for the cold bath. Hot operations are conducted at 60°C. or higher, with the other baths operating satisfactorily at room temperature.

The effective area of the pure tin anode should be twice that of the cathodes or more. They should dissolve in a non-polarised condition and should show a grey etched appearance when working. If the anodes become polarised, the current should be stopped fora few minutes to allow the film to dissolve away. If this fails to prevent polarisation, the anode area should be increased or more potash should be added to the solution. While the bath is more suitable for short-term use, its life may be prolonged by the introduction of fresh addition agents after a few days and the maintenance of the stannous tin content above 5.5 grm. per litre in the warm bath and 11 grm. per litre in the cold bath.

The acid plating bath, usually consisting of stannous sulphate, was originally developed for tin refining process, but the introduction of addition agents has made it attractive because of the high current efficiency, the low operating temperature, and its general stability to atmospheric influences.

The bath appears to offer the best possibilities for the continuous plating of strip, and much development work is going on. It has already come into use on a commercial scale for general plating. These acid tin-plating solutions may be worked at room temperature or but little above it. Anode and cathode efficiencies are practically 100 per cent., and suitable stabilizing agents are available to prevent rapid atmospheric deterioration. On the other hand, the baths cannot be prepared from commercial stannous sulphate and, as a general rule, must be made up by electrolytic solution of tin in sulphuric acid. The baths are worked at moderately low current densities, but this is largely offset by their high yield; being in the stannous condition they yield 2.21 grm. tin per amp-hour or twice as much as the sodium stannate bath. As the solutions are strongly acid, lead or rubber-lined

tanks are preferable, but stoneware may be used. Some provision for slight heating is required, particularly in winter time.

A typical bath which has already been utilized in one or two industrial plating plants consists of:

	Per Gal.
Sulphuric acid total	13.5 oz.
Tin (dissolved anodically)	4.8 oz.
Cresol sulphonic acid	16 oz.
Gelatin	1/3 oz.
Beta-Naphthol	1/6 oz.

The solution is prepared by filling the tank about half full of water and adding the required amounts of sulphuric and cresol sulphonic acids. The volume is made up nearly to the required level and tin is dissolved anodically into the solution until the required amount of tin has dissolved. This requires 60 amp. hours for each gallon of plating solution. The current density on the tin anodes should not exceed 20 amps. per square foot, as above this they tend to become passive. If the solution is not clear, it is advisable to filter at this stage, as otherwise precipitated tin compounds will tend to absorb the beta-naphthol addition when made.

The gelatin dissolved in hot water is then added and the solution well stirred. Finally the beta-naphthol is dissolved in a small quantity of alcohol and added to the solution with constant stirring. If a slight precipitate forms, the solution should be filtered or allowed to stand for 24 hours, and it is important to keep the solution clear during use.

For general plating purposes without agitation, the bath should be worked at current density of 10 amps. per square foot on the cathode. If agitation is employed, current densities above 10 amps. per square foot may be used. Agitation of the cathodes is preferable to air agitation of the solution, as the latter slightly facilitates oxidation.

The area of the cast anodes of pure tin should be approximately the same as the cathode area, although this is not important, provided the current density at the anodes does not exceed 20 amps. per square foot. Since a slight metallic slime may be produced on the anodes, which contaminates the bath and produces rough deposits, it is advisable to enclose the anodes in bags; woven glass is ideal or bags made of woolen materials, such as

flannel, may be used. The anodes should always be kept in the solution, as the presence of metallic tin helps to retard oxidation of the solution during idle periods.

Precipitates in the bath may occur from three sources: (1) slime from the anodes if these are not enclosed in bags; (2) slow precipitation of the addition agents; (3) basic tin compounds formed through oxidation, particularly if the cresol sulphonate content is low.

If precipitates are allowed to contaminate the bath, they may cause rather porous deposits. For this reason, periodic clarification is required. In some cases continuous filtration may be advantageous or, on the other hand, the bath can sometimes be kept in a clear state by allowing any precipitates to settle out. Since the tin content of the bath remains quite constant, the principal control involved is in the acid content and the addition agents. Deterioration of addition agents may be recognized by changes in the voltage across the bath, in the grain sizes of deposits and in the covering power of the solution.

An important feature of the bath is its ability to cover the surface of the cathodes within a short space of time. This property depends on the addition agents in the solution and the current density of deposition. With insufficient addition agents, the tin is not deposited uniformly over the whole cathode, and a covering power test will provide a good method of controlling the addition agents.

Two special tin plating baths deserve mention. Plating of the interiors of kettles, pans, tubes, etc., with a stannate bath, it is sometimes impossible to get satisfactory condition for tin anodes and insoluble anodes of nickel or iron are used. Working in this way, satisfactory deposits can be obtained, but the solution is depleted of tin and has to be regenerated.

The stannous ammonium oxalate bath is simple to prepare and is suitable for doing odd batches of plating, but can be worked only at low-current densities. The composition of the bath is 50 grms. per litre stannous oxalate; 60 grms. per litre ammonium oxalate; 15 grms. per litre oxalic acid; 2½ grms. per litre gelatin or peptone. Working temperature is 20°C.; cathode efficiency practically 100 per cent. The preferred density is 5 amps. per square foot. The pH of the bath should be kept around 3.5.

—Reprinted from Canadian Metals and Metallurgical Industries, August 1939.

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTROPLATERS' SOCIETY

Bridgeport Branch. The regular meeting of the Bridgeport Branch was held Sept. 7, 1939 in the Chamber of Commerce Rooms, Stratfield Hotel. The meeting was conducted by Pres. William Ehrencrona and about 30 members were present.

Special Committee: Joe Sterling gave a report on the outing. The following members at the meeting offered to donate prizes at the outing: Joe Sterling, Ben Kusterer, C. McElroy, Bill Ehrencrona, Fred Duncombe, Joe Schneider, and Gene Phillips.

Communications: A letter of appreciation from Howard Rice was read and placed on file.

A letter of resignation, from T. Bailey Curran, was read and accepted.

A letter from A. B. Wilson, chairman of the Research Committee was read and the following members of the Bridgeport Branch were appointed to the Branch Research Committee: Dr. Meyer, Clarence Helmle, C. McElroy.

The applications of Mr. Albert V. Kassery and Mr. Thomas H. Wilber were accepted.

Unfinished Business: Joseph Sterling made a convention report which was accepted.

New Business: A motion was made and carried to send Wm. Kennedy a check for 25 A.E.S. buttons he sent us.

Bills against the Branch were ordered to be paid.

Good of the order: Dr. Meyer advised the members that the convention proceedings would be ready shortly for distribution.

Fred Duncombe suggested members of the Branch be advised of any unemployment within the Branch at the meetings.

Librarian Clarence Helmle expects R. O. Hull and LeRoy Beaver as possible speakers at our open meetings in the near future.

Treasurers report was read and accepted.

Educational: Clarence Helmle started an interesting discussion of "Emulsifiable Solvent Cleaning", in which the members took part.

Meeting adjourned about 10:45.

EUGENE PHILLIPS, *Sec.*

Philadelphia Branch Board of Officers meeting called to order by President Underwood. Roll call of officers showed all present. Applications of Mr. Charles W. Wilson and Mr. Thomas J. Fagden read. Motion made and seconded same be referred to Board of Managers was carried. Communication from Executive Secretary W. J. R. Kennedy read, moved and seconded same be received and request be complied with.

Resignations of Mr. H. S. Henning and Mr. W. R. Schoefield accepted. Mr. Specht was suspended.

Resolutions Committee reported progress. Lancaster Committee reported arrangements for Meeting September 22, 1939 at 8.30 P. M. at American Legion Hall at Lancaster. Philadelphia members are to travel by bus which will leave Broad Street and Erie Ave., at 6.30 P. M., Friday September 22. Dr A. K. Graham will lecture on "Cyanide Spotting Out". After the discussion refreshments will be served, with door prizes for the lucky ones.

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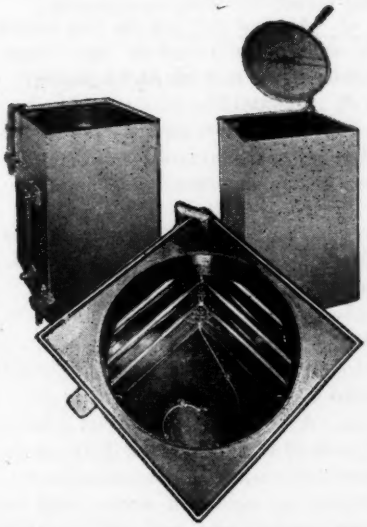

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Banquet Committee Chairman, Mr. John L. Nelson reported progress; Dr. A. K. Graham appointed Chairman of Educational Session also reported progress.

There being no further business, meeting adjourned until September 22, 1939, at Lancaster, Penn.

ROBERT E. JACKSON JR., *Sec.-Treas.*

Chicago Branch The regular monthly meeting of the Chicago Branch was held on Aug. 12, 1939 with President J. W. Hanlon presiding and all other officers present.

Application of J. W. Fox was accepted to membership.

The Branch was honored with a visit from our Supreme President Mr. R. Goodsell who had a few words to say to the members.

The following questions were found in the question box.

Q. At what pH can the best results be obtained in a rochelle salts copper solution prior to bright nickel plating?

A. About 12.5.

Q. Does sodium perborate have a detrimental effect on nickel deposits when used as an antipitting agent?

A. No.

Q. What causes a tellurium lead chrome tank lining to perforate when no current is on it?

A. Stray Currents was thought to cause this trouble.

Q. What is a good strip for bright nickel plated cold rolled steel?

A. A solution composed of 3 to 6 pounds of sodium nitrate, 1/16 ounce theosulphate and 10 cc ammonium hydroxide per gallon of water, used at room temperature and 100 to 125 amp./sq. ft.

M. H. LONGFIELD, *Sec.-Treas.*

Cincinnati Branch The regular monthly meeting of the Cincinnati Branch, American Electroplaters' Society, was held Thursday evening, August 24th, in the Hotel Metropole.

The minutes of the previous meeting were approved as read.

Mr. Ross Newton, of the Mosler Safe Company, was elected to Active Membership.

The Secretary was requested to get in touch with the Executive Secretary about complaints received from two of our new members not receiving their MONTHLY REVIEW.

John Daymude of the Crosley Corporation gave a talk on "Tin Plating". He supplied mimeographed copies to all the members before giving his talk so that they could follow him as he went along with the discussion. This made it very interesting. The subjects covered were Tin Analysis, Standard Solutions and their makeup, Solution Checks,

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an Idle Tank, Sludge Tanks, Temperature of the Plating Solution, and Tin Anodes. Everyone agreed that this was a very interesting talk and that Mr. Daymude has given the other members something to shoot at.

MARTIN GANNON, JR., *Rec. Sec.*

Binghamton-Syracuse Branch.

After attending the picnic of the Buffalo, Rochester, Toronto, and Syracuse-Binghamton Branches, the Secretary of the Binghamton-Syracuse Branch wishes to have it definitely known that his Branch had nothing whatever to do with the arrangements for the affair other than inviting our distinguished and dignified Executive Secretary Bill Kennedy to it, and that proved to be about the worst thing he has ever done for the A.E.S., but bringing the Supreme President along was Bills own idea.

It was a distressing sight to see two dusty, forlorn men drag their weary way into Bauer's Grove, (where the picnic was held), no notice was taken of them for quite some time, the boys evidently thinking they were two old time shiners, perhaps looking for a hand out. It appears the Buffalo Branch had neglected to have the band out to meet them at the Buffalo depot and they had had a terrible time finding this Bauer's Grove, (and no wonder), finally having to thumb their way out there.

Terrible to relate, this was not all. The Buffalo branch who really put this thing on are evidently a blood thirsty crowd as they had one of those very brutal exhibitions called wrestling on the program. It looked like a put up job tome, when Mike Polienski threw Count Ratoff into Ray Goodsell's lap. Even such dignified members of the Buffalo branch as Dr. Wernlund and Bert Sage (who has evidently lost all his New England culture and his present Harvard associates have no effect on him) not to mention Joe Ruff, who was terrible (I actually heard him tell the Count to bite Mike) thought it was funny.

I do hope that by now the Buffalo Branch has adequately taken care of this matter to the Supreme Officers satisfaction. It was my lot to ride up from Rochester with the Rochester boys, and to my way of thinking, it was quite a ride. All the old time harmony was of course in evidence under the culpable er-- I mean capable leadership of Fred Bruening assisted by the bottle er-- I mean baton waving Ray Berghold. The boy soprano Jerry Lux was in fine shape and the solos of Frank Kohlmeyer were a caution, Cecil Trembicki had the edge on Ray Berghold on this trip, Anodex being easier to pronounce than Cathonodic. The Roch-

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ester Yell which the boys practiced all the way up had the Bronx cheer beat a mile. I think Jud Elster had a lot to do with that. The traditional ball game was a tough one. The Buffalo boys had evidently expected a hard game so they had imported an umpire from New York, a tough egg by the name of Schneider (Bill). It sure needed somebody with the potency of NaCN to run that game, but this guy had it, his handling of some of the harder ones, more especially, Ray Berghold who was put out of the game, was a sight to see—his steely eyes missing nothing.

As I went over to Olean with Bert Sage, I cannot write anything about the return trip of the Rochester boys, however being back in Rochester Sunday afternoon, I called up Ray Berghold at his home and the hoose gow, but he evidently hadn't got back yet, did get over to Cecil Trembicki's house and to my amazement, he was nearly normal only mentioning Anodex about twice.

All in all with the exception of a heavy shower in the late afternoon, I think everyone had a good time.

GEORGE SIMMONS, *Sec.*

Detroit Branch. Detroit Branch of the A.E.S. met at Hotel Statler Friday, September 8, 1939 at 8.00 P. M.

The meeting was called to order by President J. W. Higgins.

The minutes of June 2nd meeting were read and approved.

Letters from our Supreme President R. M. Goodsell on the prize award for the best paper printed in the REVIEW and the 3rd Vice President, N. F. Sievering on membership were read to the members. Mr. Wm. McCord was appointed chairman of the membership committee.

A letter from the Research Committee Chairman A. B. Wilson, was read, and the following branch committee consisting of Mr. W. W. McCord, Chairman, and Messrs Fretts, Pinner, Beckwith, Strausser and Higgins was appointed.

An announcement was also made of an invitation to attend Grand Rapids Branch meeting to be held at Mr. Joe Nook's in Kalamazoo, and several members announced they would attend.

The Board of Managers reported favorably on three applications, and they were elected to membership. The new members are:-Mr. Richard J. Amberg, Associate, Johns Manville Sales Corp.; Mr. Charles R. Pollock, Associate, Park Chemical Co.; Mr. Frank H. Wilbur, Active, Cadillac Motor Car Division.

The following applications were read and given to the Board of Managers for approval:-Alexander A. Reicher, active, Holley Carburetor Corp.; War-

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0.9—1.5 (copper, etc.)	silver)
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The speaker of the evening, Past Supreme President, Wm. M. Phillips, General Motors Research Laboratories, was introduced and gave his illustrated talk on "Impressions of European Plating Practices and Other Relevant Matters". The slides and talk given in Mr. Phillips inimitable manner was most interesting and entertaining.

Dr. Saltonstall took charge of the question box, and the discussion on the questions was certainly entertaining as well as educational.

Announcement was made of our next meeting on October 6th when Mr. F. C. Mesle, Oneida Ltd., Oneida, N. Y., will talk on "Plating and Testing Adherent Deposits". Mr. Mesle is known for his "Mesle Chord Method", and for several papers presented before the National Conventions.

No further business — the meeting was adjourned.

W. W. WILSON, *Sec.*

New York Branch held their August meeting on Friday, the 14th, at their headquarters on the Mezzanine Floor of the Hotel Pennsylvania. It was a very warm night with small attendance present and only routine business and communications were attended to.

The September meeting was held on Friday, September 8th. A large attendance was had and matters of interest from the National Research Committee Chairman, Mr. A. B. Wilson, and President Goodsell of the A.E.S., were taken up and discussed. A committee of five headed by Dr. Young as chairman was appointed to contact all members of the Branch relative to an expression of opinion and suggestions as to what the Research Program should be. Another committee was also appointed to see what could be done in regard to President Goodsell's suggestions in his letter to the Branches. There were three new members elected at the September meeting. Business was adjourned at 11.15 P. M.

The New York Branch will hold their October meeting on Friday, October 13th. This is the evening of the day set for the National Research Committee meeting of the A.E.S. in New York City.

The Branch, through its President, R. J. Ligouri, extends a cordial invitation to the members of the Research Committee and all those interested in the A.E.S. present in New York on that date to attend the meeting

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of the Branch on that evening at the Hotel Pennsylvania at 8 P. M.

F. J. MACSTOKER, *Sec.*

Milwaukee Branch. The 300th regular meeting of the Milwaukee Branch was called to order by President Jack Geissman at 7:45 p. m. September 7, in the Colonial Room of the Republican Hotel. In spite of the unseasonably hot weather, we had an attendance of twenty-five.

The first order of business was the appointment by the chair of Dexter Rhodes to act as Secretary pro tem, as our former Secretary Robert Goodsell resigned, because his new position with A. Y. McDonald Co., took him to Dubuque, Iowa. (Good Luck, Bob).

Supreme President Ray Goodsell addressed the meeting and urged the members to participate in the contest for the fifty dollar prize offered for the best paper published in the REVIEW this year. He also brought to our attention the new dress for the REVIEW, and reminded us all to remember an exhibit for the Dayton Convention next June.

Delegates Rodney Olsen and Harry Unke read their report on the 1939 convention.

It is my sad duty to report the death of two of our oldest members, Ed. Werner and Charley Howard.

Our budget committee made its recommendations, and the budget for the ensuing year was adopted.

Under new business, Dexter F. Rhodes was elected to the office of Secretary-Treasurer for the balance of the current fiscal year.

Meeting adjourned at ten p. m. and refreshemnts were served.

DEXTER F. RHODES, *Sec.*

Cleveland Branch. The regular meeting of the Cleveland Branch was held Saturday evening, Sept. 9th, 1939, in Parlor 34, of the Hotel Cleveland. There was an attendance of 22, which was pretty good, in view of the rainy night.

Due to the fact that President Matts is confined to his home with an infection in his hand, Vice President Carlsen wielded the gavel.

Mr. Richard J. Morrow, of the Ashtabula Chrome Plating Co., Ashtabula, Ohio was elected to Active Membership in the Cleveland Branch.

Mr. Scott, as Chairman of the Silver Jubilee Committee, announced that the plans for our 25th Birthday Party were practically completed. The Committee has set the date as November 11th, and has selected the Empire Room of the Hotel Cleveland as the spot for the big doings. Mr. Scott has promised to have the tickets on hand at our October

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meeting. These will be $2.50 each. Mr. Scott is asking that a return on the number of tickets sold be made at our November meeting.

Mr. George B. Svenson has been appointed Chairman of the Membership Committee, and is laying plans for a Membership Drive in conjunction with the National drive laid out by Mr. N. F. Sievering.

A letter was read from R. N. Goodsell, urging the members to prepare papers and enter them in a new competition that is being arranged under the direction of the Supreme Society. As there is a prize of $50.00 for the best paper, it is well worth the while of our members to give consideration to this. Librarian Hull will continue to emphasize this among the membership between now and the Dayton Convention.

The Delegates to the 1939 Convention gave very fine reports of their attendance at the Convention. Mr. Matts covered the general program, Mr. Scott reported on the educational sessions and Mr. Ott covered the entertainment.

Mr. Hull gave a more detailed description of the scope of the course he is to teach for platers at the John Huntington Poly-technical Institute this fall. The registration for this course can be made any evening during the week of September 18th at the Institute. This course is receiving very favorable mention, not only among the platers, but also among the members of the Electro-chemical Society, as well as among the regular students of the Institute. As a large enrollment is expected, Mr. Hull suggested that it would be well for the platers to register early.

Librarian Hull announced that Dr. C. J. Wernlund, of the duPont Company would be the speaker at our October meeting. We would like to urge a large attendance at this meeting, because Dr. Wernlund will be well worth hearing.

P. R. LYONS, *Sec.*

Buffalo Branch. On September 9, the Buffalo Branch held its annual picnic. It was considerably augmented by members from Rochester, Binghamton, Syracuse, Elmira and Toronto.

We were honored by a visit from our Supreme President, Mr. R. M. Goodsell, and our Supreme Secretary, Mr. W. J. R. Kennedy.

The highlight of the day was the ball game between Rochester and Buffalo. "Cyanide Bill" Schneider had the precarious job of umpiring with Ves Gartland on the bases. Buffalo led 4 to 1 at the end of the second inning. At this time, several slanderous aspersions were cast on the integrity of the umpire by Ray Bergholz and Gerry Lux.

Rochester finally won by a score of 9 to 6. This remarkable comeback was due in small measure to the brilliant fielding of Jud Elster, who displays all the grace and agility of a ballet dancer, despite the fact that he has been unable to see his toes for years. Buffalo has promised however, to show Rochester the finer points of the game next year.

Despite unfavorable weather conditions the rest of the program was carried through in a very efficient manner. As darkness fell the Rochester contingent were rounded up and finally sent safely home in their bus under the protective wing of Jud Elster.

The day was thoroughly enjoyable and as this was the first time that the Buffalo Branch had attempted anything in such a large scale it augurs well for the future.

We wish to acknowledge with deep appreciation, the gifts donated by the various supply houses which contributed largely to the success of the outing.

WILLIAM HART, *Sec.*

Montreal Branch. On the evening of August 24th, the members of the Montreal Branch of the A.E.S., were the guests of Mr. Larriviere, past President of the Branch, on a yacht trip down the St. Lawrence River; this river a beautiful scene at all times is more so at night with the moonlight reflecting off its waters, the fresh air and cool breezes are a combination that any plater can appreciate.

Our host, typical of the outdoor man, tanned and in excellent condition, arranged a program for the evening that started off with supper at the Vannini Inn; needless to say the boys were in form, the courses were put away in good style with the Soupe aux Pois and rolls taking honors, the repast justified, the gang hie'd down to the yacht landing where each one walked the plank with calmness becoming a seaman. Everyone safe aboard, Mr. Larriviere demonstrated that he is a capable navigator maneuvering his boat around the islands, past the points, across the bays into open water with a skill worthy of mention.

The boys attempted "That Old Gang of Mine" with the key going over board, the evil necessary to "Sweet Adeline" not in evidence, cards were suggested.

Charles Doherty became the target for some good natured slams both little and grand, he'd left the cards ashore! Nothing left to do but swap stories with several quotations from the "Esquire" by Chas. Douglas, a raconteur par excellence. Ewart Creighton countered with some fast ones,------ enough said.

Back at the Inn for refreshments where an Orchestra was playing to a dance audience. Mr. J. H. Feeley showed the younger set that he is just as much at home on a dance floor as in a plating shop. He had for his dance partner none other than the delightful Mrs. Larriviere which probably accounts for J. H. dancing through the three numbers and the encore. Eugene Feeley kept the family to the fore by following in his father's footsteps.

R. Gordon recently back from vacation was seen smoking cigarettes proving his holidays must have been appreciated. Dan McMullens, John Reisenburg and his son and yours truly were among those present.

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It was decided that at some future date another outing of this nature would be quite in order with the ladies present.

Our sincere thanks to Mr. and Mrs. Larriviere for the very pleasant evening they showed us. The boys went home highly satisfied.

A. W. JEROME, *Sec'y.*

Toledo Branch meeting was called to order Sept. 7th at 8.30 o'clock, in room 224 of the vocational high school, by the president, Mr. Miner.

Minutes of the previous meeting were read and approved, a letter from Mr. R. M. Goodsell was read, and tabled, to be acted upon at the next meeting.

Mr. May passed out slips of paper, and suggested that each member write down several subjects that they would like to have discussed during the year, and upon these suggestions he intends to build the educational program for the year. The applications of Arthur H. Losey, and Manning A. Snell were approved.

The Toledo branch had the very great honor of having four distinguished gentlemen in the National Society, as guests at the meeting, President Goodsell, Mr. Frederick Fulforth, 1st vice president, Mr. Kennedy, executive secretary and Mr. Wilson, formerly president of the national society.

Mr. Wilson gave a short talk, asking for the cooperation on the research work.

Mr. Kennedy also said a few words, and made several suggestions, in the interest of the branch.

At this time the chair appointed the following members on a research committee, Mr. Lester Cope, Mr. James Nagle Jr., and Mr. Walter Weiker.

Mr. Frederick Fulforth, the main speaker for the evening gave a very splendid talk on "The Story of Steel Electroplating", and showed moving pictures of the manufacturing processes involved in making a high finish steel. Mr. Fulforth then passed out samples showing plating done on this high finish steel without any polishing. The paper stirred up a lot of interest among the members.

Mr. Fulforth very capably answered the many questions asked him, by the interested members. The Toledo branch is proud in having had the honor of having Mr. Fulforth speak before their meeting. Meeting adjourned at 10:30 o'clock.

G. H. BERGEMAN, *Sec.*

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Pittsburgh Branch. The first fall meeting of the Pittsburgh Branch was held Friday evening, September 8th in the U. S. Bureau of Mines Building. The meeting was called to order by our new president, Mr. S. E. Hedden at 8:30 P. M. Mr. Richard Hummel was reappointed chairman of the membership committee. It was suggested that a member of our branch give a short paper or talk in addition to that given by an outside speaker at each meeting.

The premier showing in this district of the moving picture, "Making Shaping and Treating of Steels" was presented by the Carnegie-Illinois Steel Corporation. The Branch enjoyed the film very much as it furnished an interesting insight to the making of steel today.

The next meeting will be held Friday, October 6, at the Bureau of Mines. The meeting was adjourned at 10:15 P. M.

F. R. KELLER, *Sec'y.-Treas.*

Chicago Branch. The regular monthly meeting of the Chicago Branch was held on Sept. 9, 1939.

President J. W. Hanlon presiding and all other officers present.

Communications read and acted upon by the Branch.

Application of F. E. Wanstroth accepted to membership.

Mr. H. I. Hansen presented a discussion on the Moly-black process recently presented at the convention, which proved to be very interesting.

The following were found in the question box.

Q. Does the gold chloride hydrochloric acid bath give the same 24 karat color as the gold cyanide bath? Will the article be plated bright? Can a 12 karat color be plated with this type of bath?

A. The color will vary with the composition of the bath, it will not be bright and it is difficult to hold a uniform color.

Q. How can water stains be prevented on cadmium plated steel?

A. By adding precipitating thinner or a wetting agent to the hot water.

Q. How is cast iron prepared for hard chrome plate?

A. Clean and dip in 10% muriatic acid.

M. H. LONGFIELD, *Sec.*

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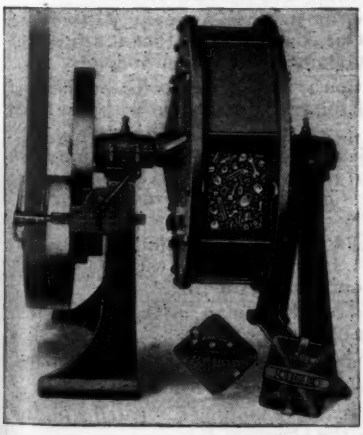

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Letter From Our President

You may think it is a little early to talk about next year's convention, but from past experience I have found it pays "Not to put off until tomorrow what you can do today".

In answer to a request from Charles Conley, Chairman of the Convention Committee, Fulforth, Kennedy and I paid a visit to the Dayton Branch at which time a tour of inspection was made and a discussion was held on convention topics. We definitely were convinced that Dayton is an ideal city in which to hold the annual convention of the Supreme Society. The Dayton-Biltmore Hotel has adequate facilities for all the activities that are necessary for this annual affair. It was a pleasure to meet the entire committee and I feel sure that under the leadership of Charles Conley, Chairman, the Dayton Convention will meet with the approval of all who attend.

In a recent letter from the Chairman of the Research Committee, addressed to the various branches, he has asked you to present a topic for the Research Committee's consideration at the meeting to be held by them Friday, October 13th. Here is an opportunity for those who have criticized the work of the Research Committee in the past to suggest something that will be of interest to the Society as a whole. This is your opportunity to express your opinion as to just what subjects you would like to have taken up. Please comply with his request.

I wish to thank the members for their hearty cooperation in the activities of the Executive Board thus far, for the splendid way in which you have responded to appeals of the various committees. I am sure that during the remaining months of their office this same spirit of cooperation will continue.

R. M. GOODSELL, *President*

THE HOT NOSED REPORTER TELLS ON DETROIT BRANCH MEMBERS

Bob Redmond and Tim Muelenberg have moved their company, Automotive Rubber Corp., to 8601 Epworth Blvd. Our comments are that it's time the boys came out in the open street instead of hiding behind a parking lot.

Chas. Beaubien was lost during his vacation at Lost Lake Woods — wherever that is, and will probably entertain his customers from now on with the usual fish stories, and how much he can eat.

Wm. Phillips can certainly keep his audience wide awake, and attentive when he talks. The slides made from his actual photographs were very interesting even if his French views were of buildings instead of the "French postcard" type.

We were glad to see Mr. A. G. Spencer who drove in from Flint. Other members from Flint and Saginaw were present, but Mr. Spencer with his distinguishing crown of gray hair seems to stand out in the gathering.

Mr. John King, his son Ralph King, and Mr. R. Suman, of Dayton Branch, were welcome visitors at the first meeting of the season.

Floyd Oplinger was also at hand to help out in the question box discussions.

Carl Huessner was conspicious at the meeting by his absence.

The proverbial tenacity of the Bull Dog is a mere nothing compared with the way Dr. Saltonstall goes after answers for the Question Box.

Herb Kersman is the proud father of an 8 pound baby boy which arrived recently.

Tom Kirby just returned from his annual fishing trip on the Magnatawan River, with fish stories that make Bob Leathers so-called big ones look like minnows.

At the mention of the Detroit Branch Educational Session and Banquet on Saturday, December 9th, the fellows are "raring to go" to help make it bigger and better than ever.

Mose Cherry formerly Michigan manager for Hanson-Van Winkle-Munning Co., recently resigned to become associated with A. T. Wagner Company of Detroit. Mose is a good fellow and his many friends wish him the best in his new connections.

Mr. and Mrs. Jim Higgins went east on their western vacation. We cannot speak for Mrs. Higgins, but Mr. Higgins needed a vacation about as badly as Joe Hoefer needs a comb.

Art Barnett, the Steel Materials' plating "Generalissimo" went a-fishing and caught a bottle - but no fish.

On the strength of the publicity given Bill Phillips in this column in the last issue of this publication, Mr. Phillips has recieved many lucrative offers from country clubs as Pro and Golf Instructor. Mr. Phillips, however, remains true to the plating industry. Mr. Phillips now requires a manager to handle his many golf engagements and lecture appointments and anyone who thinks he can fill the job may make direct application to Mr. Phillips, c/o General Motors Corporation. It will be nice work if you can get it.

It has been rumored that Carl Huessner is about to embark on a diet as per doctor's orders. He has been on everything else, so this will be novel.

The local job shops are going great, and all of the boys expect a very nice business for the balance of 1939.

Automatic Centrigufal Clutch - A 4-page leaflet has just been published by Dawes Equipment, Inc., 2280 Penobscot Bldg., Detroit, Michigan, giving details on the construction and applications of the new D-E Automatic Centrifugal Clutch for all kinds of industrial power drives. This combination clutch and flexible coupling is simple and rugged in design, positive and smooth in action, and requires no service.

Edward Werner

Edward Werner, 65 who operated an electroplating business here until his retirement about six years ago, died Saturday morning. For several years he had been living at the Antlers hotel.

Mr. Werner, who was born in Vienna, Austria, came to this country at an early age and had lived in Milwaukee 45 years. He is survived by a brother, Adolph, in Milwaukee, and by many nieces and nephews.

Apologies to E. Reed Burns & Co.

Last month's editorial contained the names of advertisers in the REVIEW for the past year. Through an oversight the E. Reed Burns Co. ad was not mentioned. Since this company has been one of our advertisers for several years, we wish to include it in the list published in the August Issue. Our apologies are extended to the E. Reed Burns Co. and our sincere appreciation of their valued friendship towards the A.E.S. is hereby expressed.

Greensburg Industry Coming to the Front

For about a year there has been a corporation going along doing business on a profitable basis here in Greensburg. It is the Century Fittings Company.

Just a month ago the president of this corporation, Wm. J. Burkart was called very suddenly by death.

Last week the Directors very wisely chose as the successor to this office, Wilfred S. McKeon. Mr. McKeon is a member of the Greensburg Civic and Business Association and president of the Sulphur Products Company, Inc.

They manufacture bronze solder fittings. The company owns a patent on a Wadge-Lock Fitting on which they expect to get into production during the coming year.

The Company's eastern sales office is located at 501 Fifth Ave., New York City. Mr. John Munro, First Vice President, is in charge of sales there. The remaining officers are as follows:

Edward P. Doran, 2nd Vice President, Greensburg; John Darr, Secretary, Ligonier; Edward F. Howard, Treasurer, Greensburg.

Sign in the bar at Sandy Mac's Golf Course, Detroit:

What is so rare
As a day in June?
A drink on the house
In a Scotch saloon.

Dayton Convention Slogan:

Wing your way to Dayton,
the birthplace of aviation.

NEWARK BRANCH A. E. S.

ANNUAL OUTING

The Place: **Vogel's Grove, Union, N. J.**

The Date: **September 30th, 1939**

The Time: 12 noon to 8 p. m.

The Menu: Celery, Radishes, Hot Dogs, Sausages, Clams Steamed and on the Half Shell, Hamburgers, Corn, Beer and Soft Drinks.

Directions: From Newark take # 29 highway to Springfield Road which lies about one-half mile from the "Flagship"; turn right on Springfield road about one-half mile; turn left into Vogel's Grove.

Admission: Adults $2.00 Children $1.00

Threefold Superiority

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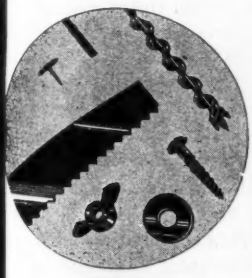

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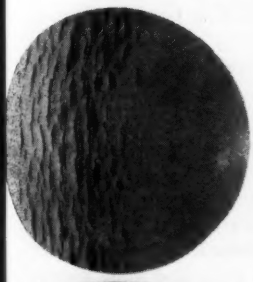

2. An Excellent Paint Base

JETAL is an excellent base for modern paints, lacquers and enamels. It retards rust formation . . also allows subsequent coatings to develop their true adherence to the metal. Cut shows impact test made on enamel over JETAL. Note that the enamel film is still firmly adherent to the steel . . is finally fractured only when the steel itself parts. In such impact tests JETAL and enamel showed 300% more adherence than enamel and steel and no breakdown after 2,000 hours in a humidity cabinet.

3. An Effective Rust-Resistant

JETALized iron or steel, dipped in our Jet-oil, stops corrosion attack for long periods of time — in laboratory tests showed no appreciable attack after 165 hours in salt spray.

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The Abstract Section

FREDERICK FULFORTH, *Chairman, Program and Educational Committee*

ABSTRACTS FROM THE NICKEL BULLETIN
published by the
Mond Nickel Co. of London, England

1. The following abstract is part of an article in the Nickel Bulletin which is a summary of the paper "Sintered Metal Filters for Purification of Concentrated Alkali Solutions" by L. SCHLECHT and G. TRACESER as published in *Chemische Fabrik* 1939, vol. **12,** pp. 243-4.

The I. G. Farbenindustrie has patented a new process for making Sintered Nickel of various forms for use in filtering hot and concentrated alkali solutions. This nickel powder is made by the thermal decomposition of Nickel Carbonyl. The Sintered Nickel filter is much more resistant to alkali than glass, porcelain, silicon carbide or filters made from vegetable or animal fibre.

2. This is a complete abstract of an article in the Nickel Bulletin on the paper "Application of Electrolytic Polishing to the Micrographic Examination of Iron and Steel". By P. JACUET and P. ROCQUET in *Comptes Rendus* 1939, vol. **208,** pp. 1012-14.

An electrolytic method of polishing, originally developed for use on copper, aluminum, tin and certain other metals has been further developed for use with ferrous metals. The electrolyte found to be most satisfactory for iron and steels, is an aqueous solution of acetic anhydride and perchloric acid. The material to be polished constitutes the anodes and the cathode is a sheet of aluminum or iron. The current density is of the order 4-6 amp. per sq. dcm. of anode surface and the solution should be gently agitated during operation. A satisfactory polish is obtained in 4-5 minutes. With suitable adjustment of concentration and operation, this type of treatment may be used for plain and alloy steels, including nickel steels and austenitic nickel chromium steels, and for cast iron. In the case of carbon steels the addition of 0.5 per cent of aluminum to the polishing solution is beneficial.

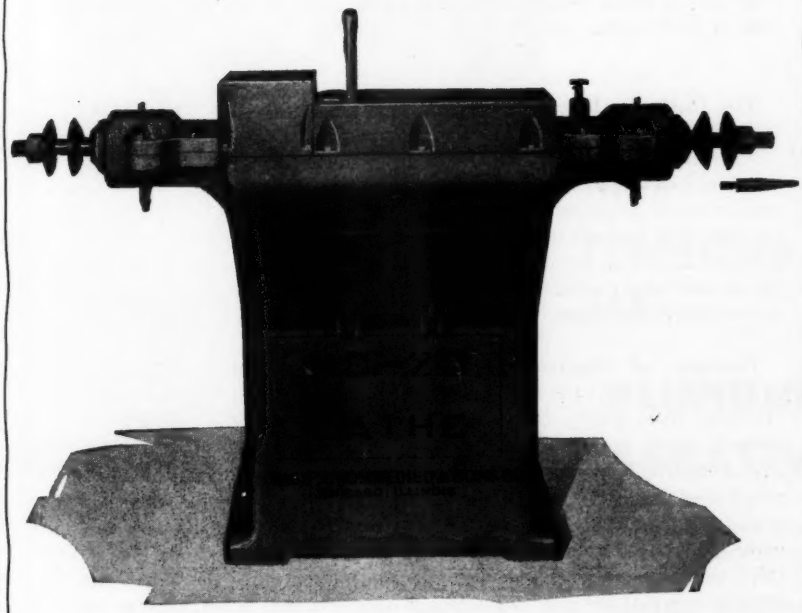
ROBERT R. SIZELOVE

Anodes For the Electrotinning of Manganese. By COLIN G. FINK and MORRIS KOLODNEY. *Trans. Electrochemical Society* **76,** (Preprint 76-5) (1939); cf. Abstract Section, *Monthly Review, American Electroplaters' Society,* November 1938, p. 864. The development of an insoluble lead-tin-cobalt anode which will not form manganese dioxide in manganese electrodeposition, is fully described. By cutting the cost of obtaining manganese from American ores it makes a domestic manganese industry much more possible. The anode is applicable as an insoluble anode in other sulfate solutions.

ERNEST H. LYONS, JR.

The Electrodeposition of Lead from Solutions of Lead Sulfamate with Addition Agents. By FRANK C. MATHERS and ROBERT B.

Variable Speed Lathes Lower Your Buffing Costs



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COMPLETE PLATING PLANTS INSTALLED

Please mention THE MONTHLY REVIEW *when writing*

FORNEY: *Trans. Electrochemical Society* **76,** (Preprint 76-6) (1939). Commercial sulfamic acid, $HSO_3.NH_2$, recently announced, offers possibilities for lead plating, since its lead salt is soluble; however, acid solutions of lead sulfamate give badly treed deposits. Experiments with 193 combinations of addition agents are reported. For nine successful baths, the throwing power, current efficiency, and effect of free acid were determined. The lead deposits were smooth, finely crystalline, and tough. The best addition agents are combinations of aloin, B-napthol, casein, malic acid, pyrogallol, resorcinol, glue, cresylic acid, goulac, and furfural. Bath compositions, etc,. are given.

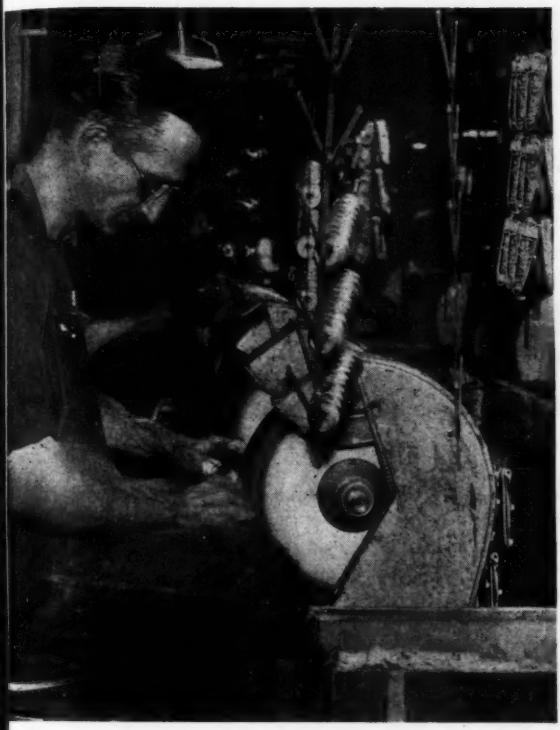
ERNEST H. LYONS, JR.

The Cathodic Behavior of Zinc versus Iron in Hot Tap Water. By GERHARD SCHIKORR. *Trans. Electrochemical Society* **76,** (Preprint 76-13) (1939). Although in ordinary corrosion, zinc owes its extraordinary protective power to its sacrifical electrochemical action due to its anodic behavior towards steel, tests on galvanized steel pipe show that in tap water hotter than 158°F., the zinc may become cathodic to steel and actually accelerate corrosion and promote failure of the pipe. This behavior is ascribed to the formation of a film of corrosion products on the zinc, and helps to account for unusual corrosion of galvanized pipes in hot water service. ERNEST H. LYONS, JR.

Porosity of Electrodeposited Silver on Steel. By FRANK C. MATHERS and LYLE I. GILBERTSON. *Trans. Electrochemical Society* **76,** (Preprint 76-4) (1939); cf. Abstract Section, *Monthly Review, American Electroplaters' Society*, November 1938, p. 862. Ferroxyl tests showed that the porosity of electroplated silver on steel depends on the roughness of the steel. Hot-rolled steel required 0.006″ silver, and can stock from which the tin had been removed by hot hydrochloric acid required 0.0075″ silver, to be free from pores while 0.001″ was sufficient on polished steel. Brush-plated coatings 0.0003″ thick were non-porous but lacked adhesion; apparantly the larger pits were bridged over. If the acid dip before plating was very short, thinner coatings sufficed. Thirty steel cathodes of "ordinary roughness" with 0.006″ silver showed no pores. 30% hydrochloric acid refluxed 96 hours in an armco iron crucible plated with 0.0048″ silver showed no trace of iron.

ERNEST H. LYONS, JR.

With Reference to Obligatory Apprenticeship. Editorial *Galvano* (Paris) June 1939. Page 32. On March 10, 1937, the French government passed a law to establish organization of all trades, and to that end to establish obligatory apprenticeship in those trades. Pending the drawing up of a code for the electroplating trade, there is much discussion of the probable scope and effect of new regulations. It is felt that an apprentice system, comprising a fixed period of years of work under an apprentice contract to a master workman and including specified courses of instruction, all leading to a general examination and license to operate, will have a most beneficial effect. It seems reasonable to expect a marked improvement in the quality of workers and of their work if such a system is worked out and applied properly. The general scope and particular details, however, involve many diverse and complex considerations,



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hence there is much speculation and discussion now going on. The development of the plater will be of much interest to all platers. C. T. THOMAS

METALS AND ALLOYS ABSTRACTS

1. Surface Treatment of Light Metal Pistons. "*Metallwirtschaft*" Vol. **18,** Feb. 17, 1939 pp. 151-54. Summary of methods used for coating Al pistons. Two reasons for coating (1) To prevent wetting of surface. For this use Chrome, Ni, Copper, Silver, Iron and oxide coating. (2) To improve running properties for which Tin, lead, cadmium zinc and copper can be used. Coating applied by electroplating, immersion, metal spray, diffusion and cladding. Nickel plating seems better than anodizing, and Cu better than Ni. Sn by immersion seemed best on piston skirt. Sn superior to anodizing. Metal spray of Sn has not produced satisfactory results. PHIL J. RITZENTHALER

2. Electroplating Rustless Steel. "*Mitt. Forsch Inst. Probieramts Edelmettale*" Vol. **12,** Dec. 1938 pp. 83-91. Research. Difficulty is removal of oxide film. Several methods used. Adherent silver deposits on cutlery obtained by pickle in HCl and then a layer of plated iron or zinc from acid baths. A very adherent Cu layer obtained by dipping steel in copper solution in HCl. Solu was 150g HCl and 1-5g $CuCl_2$/L, for 45-90 sec. An electrolytic Cu film gave better results. Plate in solu. of 2g $CuCl_2$ in 225g HCl_2 and 20g NaCl at C. D. of 5-15 A/SF. for 1 minute. Subsequent silver deposit must be more porous or galvanic action with base metal is set up and corrosion proceeds. Table of potentials involved is included. PHIL J. RITZENTHALER

Modern Metal Colouring. CHARLES HARRIS (Messrs. George Salter & Co., Ltd., England). *J. Electrodepositors Tech. Soc.*, Vol. **15,** 1939, pp. 97-108. The surface condition of the metal is of importance. A smooth surface is necessary if the coloring is due to light interference of thin films. Scratch-brushed or sand-blasted surfaces are useful when dense or dead coloring is required. The methods of coloring metals may be grouped under 3 heads; (1) Chemical methods; (2) heating methods; (3) electrolytic methods. Cu and its alloys are colored brown by a cu $(NO_3)_2$ solution, from which traces of sulphate must be absent, and are colored black by an ammonical copper carbonate solution. Formulae are also given for green finishes. Steel is colored black by immersion in a solution containing NaOH, 54 oz./gal; KNO_3, 1.3 oz./gal.; $NaNO_3$, 1.3 oz./gal.; heated to 259°F. Cd is colored black by a solution containing $KClO_3$ and $CuCl_2$, and is colored brown by a solution containing $K_2Cr_2O_7$ and dilute HNO_3. Brown and black colors on Al and Zn can be obtained by immersion in a molybdate solution. Steel is heat bronzed by immersion in fused $NaNO_3$. Cr, Cu, and Cu-Sn alloys can be colored by heating in air or by immersing in fused salt baths. Sn can be colored black by an anodic treatment in an acidified phosphate bath, and Mg alloys by anodizing in a bath containing a dichromate and a phosphate. The following methods of metal coloring are also discussed; dyeing anodic films on Al; electrodeposition of black Ni; the electrocolor process which uses cathodic treatment in an alkaline Cu lactate bath. A. BRENNER

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The Atmospheric Corrosion Resistance and Protective Value of Metallic Coatings. S. G. CLARKE (Research Dept., Woolwich). *J. Electrodepositors Tech. Soc.*, Vol. **15,** 1939, pp. 141-164. (Discussion pp. 165-184). The rate of corrosion of ingot iron and zinc in an industrial atmosphere was 100 and 25 times greater, resp., than the rate in a dry tropical climate. In atmospheric exposure tests of sheets of Pb, Ni, Cu, Zn, the order of the corrosion resistance of the metals varied with the climate. Zn was the most corroded in all locations. Cu was less corroded than Mi in an industrial atmosphere. In a 7 year test in an industrial atmosphere, the order of merit of various metals was Pb, Sn, Al, Cu, Ni, and Zn. Cu corroded about 1/2 as much as Ni. Atmospheric exposure tests of Ni coatings on Ni foil, showed that bright Ni deposits lost more wt. than ordinary Ni, but the bright Ni-Co alloy lost less wt. Thin Cr coatings (a few hundred-thousandths in. thick) over Ni coatings afforded little additional protection and served mainly to prevent tarnish. However, 0.0005 in. of Cr protected steel in a 20 months exposure test. Cr tends to flake off of brass. This is decreased by an undercoat of Cu, bronze, or Ni. Composite Cu-Ni coatings have less atmospheric corrosion resistance than Ni coatings of the same total thickness. Cu coatings should give good protection to steel-work, but there is some prejudice against its use because of the fear that corrosion of the basis metal would be accelerated at discontinuities in the coating. Pb coatings have been used to protect large bridge members. Steel coated with 0.001 in. of Pb showed practically no rust after 3 yrs. of atmospheric exposure. Sprayed al coatings gave good protection to steel and prevented corrosion at discontinuities in the coating. Steel coated with 0.003-0.006 in. of Al did not rust after 6 years of exposure. Zn coatings protect the steel at discontinuities in the coating, thus the porosity of the coating is not important. Zn coatings of different types (electroplated, hot-dipped, and sprayed) all gave about the same degree of protection to steel. In an industrial atmosphere, Cd coatings gave less protection to steel than did Zn coatings, but in a marine exposure, gave more protection. Steel does not corrode appreciably when exposed to an indoor atmosphere of low humidity. Cd corroded less than Zn on exposure to a humid, enclosed atmosphere. Ni and Sn plated steel was little affected by this type of exposure. SO_2 is the chief constituent in the air which affects corrosion indoors. It readily corroded steel and Ni when the humidity was over 70%. The order of merit of metals subjected to an indoor atmospheric corrosion test was Sn, Cu, Zn, Cd. The order in which metals resisted staining by handling was Cr, Sn, Ni, Fe, Cu, Zn and Cd. A. BRENNER

The Structure and Properties of Bright Nickel Deposits. A. W. HOTHERSALL and G. E. GARDAM. *J. Electrodepositors Tech. Soc.*, **15,** 127-40 (1939). Three types of bright Ni deposits were investigated: (A) Ni-Co alloy deposited from a bath containing Na formate and formaldehyde. (B). Ni deposited from a bath containing 0.7 oz./gal. of Ni naphthalene trisulphonate. (C) Ni deposited from a bath containing 4 oz./gal. of Na isopropyl naphthalene sulphonate. Ordinary Ni deposits appear matt because the surface consists of irregular mounds which scatter reflected light. The mounds

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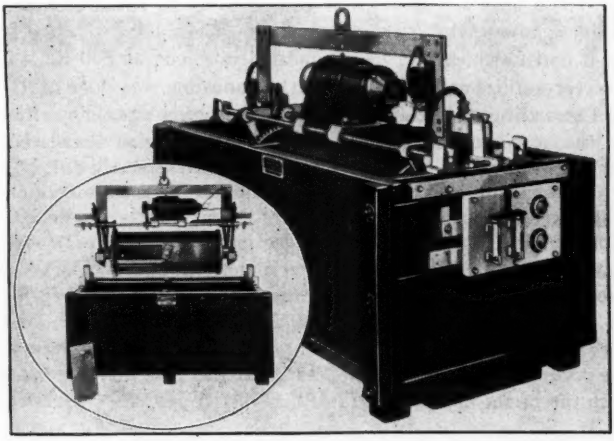

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do not have plane surfaces or crystal facets. Bright Ni deposits have a very small grain size and the surfaces are very smooth. The luster of thin (0.0001 in.) deposits of bright Ni was highest on a smooth, fine grained surface. On coarse grained surfaces the deposits had to be 0.0004 in. thick in order to appear fully lustrous. The bright deposits do not show any definite microstructure. The etched cross-section showed large numbers of lines parallel to the cathode surface. These lines are depressions caused by preferential etching, but no explanation is advanced for their production. These lines were not found on deposits B and C which had been annealed in vacuo at 570°F. Deposit C began to recrystallize at 570°F. When the annealing was done at 1800°F. in vacuo, all three bright deposits developed a fair grain size. The stress in the deposits was measured by the bending of a steel strip which was plated on only one side. Deposits A and C had a higher stress than ordinary dull Ni, but deposit B had practically no stress. By a bending test, deposit A was found to be almost as ductile as ordinary Ni. Deposits B and C were brittle. X-ray examination of A and C yielded a diffuse reflection, indicating a grain size smaller than matt Ni deposits. Deposit A showed some orientation of the crystals, but C did not. The carbon content of the deposits were: A, 0.05%; B, 0.07%; C, 0.2%. The cathode potentials of the deposition of A and C were 0.02V. and 0.15V., resp., more negative than the potentials of the deposition of matt Ni. The porosity of bright deposits was about the same as matt deposits, except when the bright deposits contained cracks. A. BRENNER

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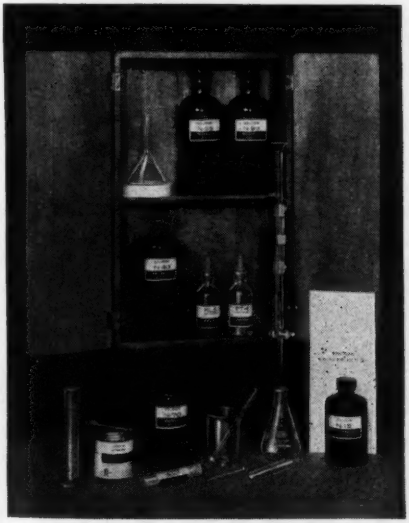

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